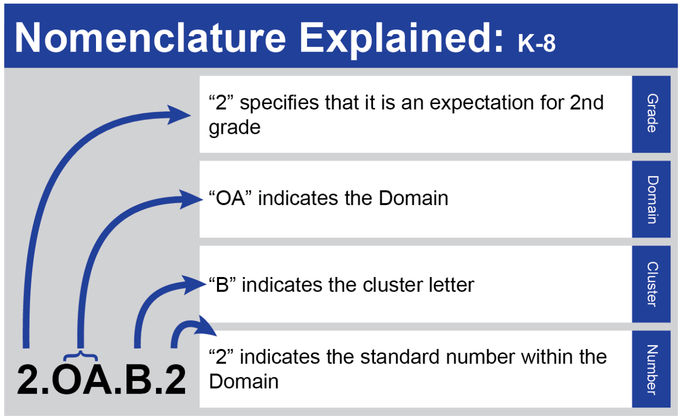
Arkansas Mathematics Standards
1st Grade
2022

Introduction to the Grades K-8 Arkansas Mathematics Standards

When the Division of Elementary and Secondary Education (DESE) began the process of revising math standards, a diverse group of qualified educators from across the state came together to craft Arkansas standards specific to the schools and students in the state. The result of this work, the Arkansas Mathematics Standards, is contained in this document. These standards reflect what educators across the state know to be best for Arkansas students.

Standards Organization: The revision committee maintained the organizational structure and nomenclature of the previous standards. K-8 Arkansas Mathematics Standards are categorized into domains, clusters, and standards.

- **Domains** represent the big ideas to be studied at each grade level and sometimes across grade bands. These big ideas support educators in determining the proper amount of focus and instructional time to be given to each of these topics.
- **Clusters** represent collections of standards grouped to help educators understand the building blocks of rich and meaningful instructional units. These units help students make connections within clusters and avoid seeing mathematics as a discrete list of skills they must master.
- **Standards** represent the foundational building blocks of math instruction. The standards outlined in this document work together to ensure that students are college and career ready and on track for success.



Standards Support: The revision of the Arkansas Mathematics Standards represent the work of the committee to provide greater clarity, strength, and support of the standards. Additionally, the revised mathematics standards are designed to help educators better understand the areas of emphasis and the focus within the standards. Educators should address the bulleted content as more than a checklist of items that they must teach individually. Content is bulleted to provide specificity of learning expectations included within some extensive standards. In some instances, the standard document includes Arkansas examples, teacher notes, specifications, and italicized words to assist educators with planning, teaching, and student learning.

- **Examples** included in the original standards were either changed for clarity or separated from the body of the actual standard. The examples included in the body of the standards document in no way reflect all of the possible examples. Likewise, these examples do not mandate curriculum or problem types. Local districts are free to select the high-quality curricula and instructional methods that best meet the needs of their students.
- **Teacher notes** offer clarification of the standards. These notes are intended to clarify, for teachers, what the expectations are for the learner. Likewise, these notes provide instructional guidance and limitations so that educators can better understand the scope of the standard. This will help with determining what is developmentally appropriate for students when working with specific standards.
- **Standard specifications** are to strengthen standards. The specifications are precise statements highlighting the need for mastery or function-type parameters for specific standards. This will assist educators in pinpointing the best opportunities for students to gain and master the knowledge and skills needed to succeed in a progression.
- **Italicized words** are defined in the glossary.

Finally, the Arkansas Mathematics Standards will be a living document. As these standards are implemented across schools in the state, DESE welcomes further suggestions related to notes of clarification, examples, professional development needs, and future revisions of the standards.

K-12 Standards for Mathematical Practices	
1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics.	5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.

First Grade Standards: Overview	
Abbreviations: The following abbreviations are for the domains for the Arkansas Mathematics Standards.	
Operations and Algebraic Thinking – OA • Represent and solve problems involving addition and subtraction • Understand and apply properties of operations and the relationship between addition and subtraction • Add and subtract within 20 • Work with addition and subtraction equations **Number and Operations in Base Ten – NBT** • Extend the counting sequence • Understand place value • Use place value understanding and properties of operations to add and subtract **Measurement and Data – MD** • Measure lengths indirectly and by iterating length units • Work with time and money • Represent and interpret data **Geometry – G** • Reason with shapes and their attributes	

Operations and Algebraic Thinking	
Cluster A: Represent and solve problems involving addition and subtraction.	
AR.Math.Content.1.OA.A.1	Use addition and subtraction within 20 to solve word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions (e.g., by using objects, drawings, or *equations* with a symbol or *variable* for the unknown number, to represent the problem). Teacher Note: See appendix for problem-type examples.
AR.Math.Content.1.OA.A.2	Solve word problems that call for addition of three *whole numbers* whose *sum* is less than or equal to 20 (e.g., by using objects, drawings, and *equations* with a symbol, could include a *variable*, for the unknown number to represent the problem).
Cluster B: Understand and apply properties of operations and the relationship between addition and subtraction.	
AR.Math.Content.1.OA.B.3	Apply *properties of operations* as strategies to add and subtract. Teacher Note: Students should be aware of the formal terms for these properties, but they should not be assessed on these terms until later grades. Examples: ● If 8 + 3 = 11 is known, then 3 + 8 = 11 is also known (*commutative property of addition*). ● To add 2 + 6 + 4, the second two numbers can be added to make a ten, so 2 + 6 + 4 = 2 + 10 = 12 (*associative property of addition*).
AR.Math.Content.1.OA.B.4	Demonstrate the relationship between addition and subtraction by solving problems using an *inverse* operation. Teacher Note: Teachers should use the term *inverse* with students. Examples: Solve an unknown *addend* problem within 20, using addition strategies and/or changing it to a subtraction problem. $12 + \quad = 18,\ 18 - 10 \rightarrow 8 - 2 \rightarrow 6,\ 18 - 12 = 6$ $18 - \quad = 12,\ 12 + \quad = 18,\ 12 + 3 \rightarrow 15 + 3 = 18$
Cluster C: Add and subtract within 20.	
AR.Math.Content.1.OA.C.5	Relate counting to addition and subtraction (e.g., by *counting on* 2 to add 2).

AR.Math.Content.1.OA.C.6	Demonstrate basic fact *fluency* for addition and subtraction within 10, with *mastery* by the end of first grade. Use basic fact *fluency* to develop *computational fluency* for addition and subtraction within 20 using manipulatives and/or strategies such as: ● *Counting on/counting back* ● Making ten (e.g., $8 + 6 \rightarrow 8 + 2 + 4 = 10 + 4 = 14$) ● Decomposing a number leading to a ten (e.g., $13 - 4 \rightarrow 13 - 3 \rightarrow 10 - 1 = 9$) ● Using the relationship between addition and subtraction (e.g., $8 + 4 = 12,\ 12 - 8 + 4$) ● Creating equivalent but easier or known *sums* (e.g., $6 + 7 \rightarrow 6 + 6 + 1 \rightarrow 12 + 1 = 13$) Teacher Note: ● *Basic fact fluency* - fluency with operations involving single-digit numbers. ● *Computational fluency* - refers to having efficient and accurate methods for computing. Students exhibit computational *fluency* when they demonstrate flexibility in the computational methods they choose, understand and can explain these methods, and produce accurate answers efficiently. ● *Mastery* - refers to teaching in a way that students develop a deep understanding of mathematical concepts rather than memorizing key procedures or resorting to rote learning or simple memorization of facts. ● Specification: Students should demonstrate *mastery* of this standard by the end of first grade.
Cluster D: Work with addition and subtraction equations.	
AR.Math.Content.1.OA.D.7	Apply understanding of the equal sign to determine if *equations* involving addition and subtraction are true or false. Teacher Note: Provide a variety of experiences with the equal sign. Examples: ● Operation on the left side of the equal sign, and answer on the right side (5 + 8 = 13) ● Operation on the right side of the equal sign and answer on the left side (13 = 5 + 8) ● Numbers on both sides of the equal sign (6 = 6) ● Operations on both sides of the equal sign (5 + 2 = 4 + 3)
AR.Math.Content.1.OA.D.8	Determine the unknown whole number in an addition or subtraction *equation* relating three *whole numbers.* Teacher Note: Examples: Determine the unknown number that makes the *equation* true in each equation. 8 + ? = 11, 5 = _ - 3, and 6 + 6 = _

Number and Operations in Base Ten	
Cluster A: Extend the counting sequence.	
AR.Math.Content.1.NBT.A.1	Count within 120: ● Count forward and back within 120 by ones. ● Count forward to 120 by fives and tens. ● Count forward and back by tens within 99. ● In this range, read and write numerals and represent a number of objects with a written numeral. Teacher Note: ● When reading and writing whole numbers, the word "and" should not be used (110 is stated and written as "one hundred ten"). ● Patterns of *place value* in spoken number words (e.g., ten represents 10 ones, -teen represents a ten and some ones, -ty represents a decade number or multiple groups of tens and ones).
Cluster B: Understand place value.	
AR.Math.Content.1.NBT.B.2	Understand that the two digits of a two-digit number represent amounts of tens and ones. Understand the following as special cases: ● 10 can be considered a bundle of ten ones - called a "ten." ● The numbers from 11 to 19 are composed of a ten and one, two, three, four, five, six, seven, eight, or nine ones. ● The numbers 10, 20, 30, 40, 50, 60, 70, 80, 90 refer to one, two, three, four, five, six, seven, eight, or nine tens and 0 ones.
AR.Math.Content.1.NBT.B.3	Compare two two-digit numbers based on meanings of the tens and ones digits, recording the results of comparisons with the symbols >, =, and <. Teacher Note: Appropriate terminology would be more than (greater than), less than, or the same as (equal to).

Cluster C: Use place value understanding and properties of operations to add and subtract.

AR.Math.Content.1.NBT.C.4

Add within 100, including adding a two-digit number and a one-digit number, and adding a two-digit number and a multiple of 10, using concrete models or drawings, relate the strategy used to a written *expression* or *equation*, and be able to explain the reasoning.

Teacher Note:

- The focus of this standard is to develop an understanding of multi-digit addition. The standard *algorithm* of carrying or borrowing is neither an expectation nor a focus in first grade. Students develop strategies for addition and subtraction in Grades K-3.
- Strategies should be based on *place value*, *properties of operations*, and the relationship between addition and subtraction.

Example: There are 54 apples in the basket. Martha put 20 more apples in the basket. How many apples are in the basket?

Possible Responses -

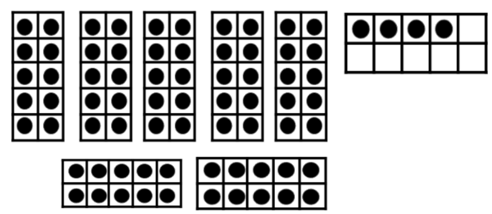
<u>Student A</u> - I used ten frames. I filled 5 ten frames. That's 50. Then I put 4 in another ten frame. That gave me 54. Then I filled 2 more ten frames for the apples Martha added to the basket. That made 74. So, there are 74 apples in the basket.

$10 + 10 + 10 + 10 + 10 = 50$

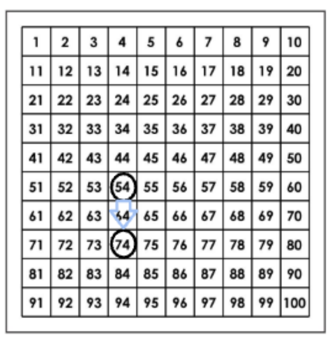
$50 + 4 = 54$

$54 + 10 = 64$

$64 + 10 = 74$

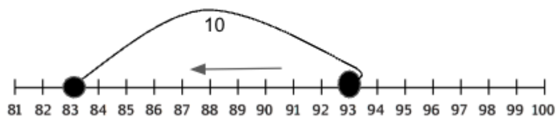
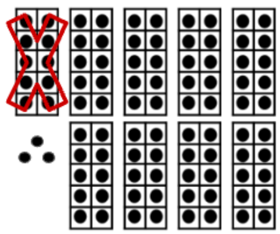


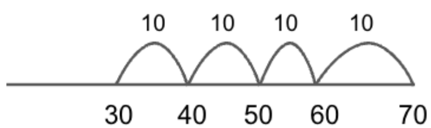
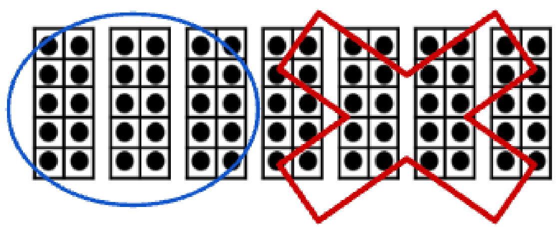
<u>Student B</u> - I used a hundreds chart. I started at 54 on the chart and jumped down 2 rows. Each jump was 10. So I landed on 74. There are 74 apples in the basket. $54 + 10 = 64$ and $64 + 10 = 74$



1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

<u>Student C</u> - I knew that 10 more than 54 is 64 and 10 more than 64 is 74, so there are 74 apples in the basket.

AR.Math.Content.1.NBT.C.5	Mentally find 10 more or 10 less than a given two-digit number, without having to count. Teacher Note: Students should be able to explain their reasoning using manipulatives, pictures, numbers, or words. Example: There are 93 butterflies in the park. 10 butterflies fly away. How many butterflies are in the park now? Possible Response - Student A - I thought about a number line. I started at 93. Then since 10 butterflies flew away, I jumped back 10. I landed on 83. So there are 83 butterflies in the park.  Student B - I pictured 9 ten frames and 3 left over. Since 10 butterflies left I took away 1 ten frame. That left me with 8 ten frames, which is 80 and my 3 leftovers. So there are 83 butterflies in the park.  Student C - I know that 10 less than 93 is 83. There are 83 butterflies in the park.

AR.Math.Content.1.NBT.C.6	Subtract multiples of 10 from multiples of 10 (both in the range of 10 - 90) using concrete models or drawings, relate the strategy to a written method, and explain the reasoning used. Teacher Note: ● Students should be able to explain their reasoning using manipulatives, pictures, numbers, or words. ● Strategies should be based on *place value*, *properties of operations*, and the relationship between addition and subtraction. Example: There are 70 students in the gym. 40 students leave. How many students are still in the gym? Possible Responses - Student A - I used a number line. I started at 70 and made 4 jumps of 10 back and landed on 30. There are 30 students left. $70 - 10 \rightarrow 60 - 10 \rightarrow 50 - 10 \rightarrow 40 - 10 \rightarrow 30$  Student B - I used ten frames. I started with 7 ten frames. I took away 4 ten frames since 40 students are left the gym. I have 3 ten frames left, which equals 30. So, there are 30 students in the gym now. $70 - 40 = 30$  Student C - I thought “40 and what makes 70?” I know $4 + 3 = 7$. So, I thought $40 + 30 = 70$. Then there are 30 students left in the gym.

Measurement and Data

Cluster A: Measure lengths indirectly and by iterating length units.

AR.Math.Content.1.MD.A.1	Order three objects by their length; indirectly compare the lengths of the two objects by using a third object. Teacher Note: Example: To compare the length of a bookshelf to the length of a desk, you could cut a string that is the same length as the bookshelf. You can then compare the piece of string with the desk. If the string is longer than the desk, then you know that the bookshelf is longer than the desk.
AR.Math.Content.1.MD.A.2	Express the length of an object as a whole number of units by *iterating*, laying multiple copies of a shorter object end-to-end. Understand that the length of one object is equal to the number of same-size units that span the object with no gaps or overlaps. Teacher Note: Limit to contexts where the object being measured is spanned by a whole number of length units with no gaps or overlaps. Example: Students measure the length of a desk using paper clips. All the paper clips must be the same size, layed end to end with no gaps or overlaps. The length or answer is equal to the total number of paper clips.

Cluster B: Work with time and money.

AR.Math.Content.1.MD.B.3	Tell and write time in hours and half-hours using analog and digital clocks. Teacher Note: The intent of this standard is to continue the progression of the concept with the goal of *mastery* by the end of third grade.

Progression of Time Skills	
Grade Level	Time Learning Expectation
Kindergarten	Tell time to the nearest hour
First Grade	Tell time to the nearest half-hour
Second Grade	Tell time to the nearest 5 minutes
Third Grade	Tell time to the nearest quarter hour Tell time to the nearest minute Solve word problems involving time

<table>
<tr><td>AR.Math.Content.1.MD.B.4</td><td>Identify and know the value of a penny, nickel, dime, and quarter.

Teacher Note:
<table>
<tr><th colspan="3">Progression of Money Skills</th></tr>
<tr><th>Grade Level</th><th>Coins</th><th>Money Learning Expectation</th></tr>
<tr><td>Kindergarten</td><td>penny, nickel, dime</td><td>Know name and value</td></tr>
<tr><td>First Grade</td><td>penny, nickel, dime, quarter</td><td>Know name and value
Count collections of like coins</td></tr>
<tr><td>Second Grade</td><td>penny, nickel, dime, quarter, dollar bills</td><td>Know name and value
Use dollar and cent symbol
Solve word problems:
● within 99 cents
● using whole dollar amounts</td></tr>
<tr><td>Fourth Grade</td><td>all coins and bills</td><td>Solve word problems including making change and decimals</td></tr>
</table>
</td></tr>
<tr><td>AR.Math.Content.1.MD.B.5</td><td>Count collections of like coins (pennies, nickels, and dimes) to determine their total value, up to 100 cents.

Teacher Note: This standard relates to 1.NBT.A.1, counting by ones, fives, and tens.</td></tr>
<tr><td colspan="2">Cluster C: Represent and interpret data.</td></tr>
<tr><td>AR.Math.Content.1.MD.C.6</td><td>Organize, represent, and interpret data with up to three categories (e.g., Tally tables, picture graphs, or bar graphs), by asking and answering questions about the total number represented.

Teacher Note:
Example:
● How many are in each category?
● How many more or less are in one category than in another?</td></tr>
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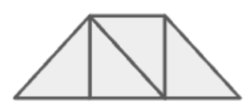
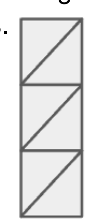
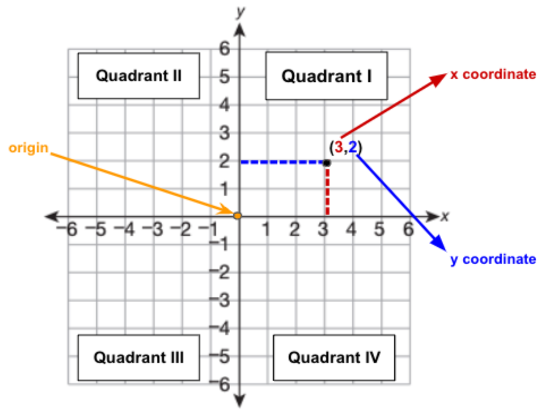
Geometry	
Cluster A: Reason with shapes and their attributes.	
AR.Math.Content.1.G.A.1	Distinguish between *attributes,* both defining (e.g., Triangles are closed and three-sided) and non-defining (e.g., Color, orientation, overall size); build and draw shapes that exhibit defining *attributes.* • Shapes to include: square, circle, half circle, quarter circle, triangle, rectangle, *trapezoids*, hexagon, cube, cone, cylinder, and sphere. Teacher Note: • <u>Defining *attributes*</u> are features that are always present and identify a particular shape such as the number of sides, lengths of sides, and the number of *vertices*. • <u>Non-defining *attributes*</u> are features that may be present and do not identify what the shape is called (e.g., Color, size, orientation).
AR.Math.Content.1.G.A.2	Use 2D shapes or 3D shapes to create a *composite shape*. • 2D (e.g., Rectangle, square, *trapezoid*, triangle, hexagon, half circle, and quarter circle) • 3D (e.g., Cube, *rectangular prism*, cone, cylinder) Teacher Note: • Students create *composite* 2D and 3D shapes. • If the *composite* shape forms a regular *polygon*, students identify the name of the *composite* shape and the shapes that form it. • If the composite shape forms an irregular *polygon*, students should begin to visualize how shapes fit together to create a new shape and notice shapes within an already existing shape. • Students will solve shape puzzles, construct designs with shapes, create and maintain a shape as a unit. Students also continue to describe the *attributes* and properties of shapes. Example: What shapes can you make with triangles? <u>Student A</u> - I made a square with two triangles.  <u>Student B</u> - I made a trapezoid with 4 triangles.  <u>Student C</u> - I made a tall, skinny rectangle with 6 triangles. 

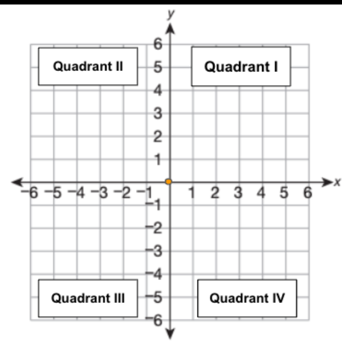
AR.Math.Content.1.G.A.3	Explore halves, fourths, and quarters: ● Partition circles and rectangles into two and four equal shares, describe the shares using the words halves, fourths, and quarters, (use the phrases ‘half of, fourth of, and quarter of’). ● Describe the whole as ‘two of, or four of, the shares.’ ● Understand decomposing shapes into more equal shares creates smaller shares. Teacher Note: Students are expected to know the terminology but not required to recognize or write fraction notation (numerator over denominator, a/b).

Glossary	
Addend	Any of the numbers added to find a sum
Additive Comparison	Compare two amounts by asking how much more or less is one amount than the other.
Additive inverses	Two numbers whose sum is 0 are additive inverses of one another; example: 3/4 and (-3/4) are additive inverses of one another because 3/4 + (- 3/4) = 0
Algorithm	An explicit step-by-step procedure for performing a mathematical computation or for solving a mathematical problem.
Associative Property of addition	A property of real numbers that states that the sum of a set of numbers is the same, regardless of how the numbers are grouped. Example: (4 + 8) + 3 = 4 + (8 + 3)
Associative Property of multiplication	A property of real numbers that states that the product of a set of numbers is the same, regardless of how the numbers are grouped. Example: $(4 \bullet 8) \bullet 3 = 4 \bullet (8 \bullet 3)$
Attributes	Characteristics or properties of an object
Axis	A vertical or horizontal number line, both of which are used to define a coordinate grid. The horizontal axis is the x-axis, and the vertical axis is the y-axis. The plural of axis is axes.
Benchmark Fraction	A common fraction used when comparing other fractions (e.g., 1/2 , 1/4)
Cardinality	The understanding that when you count items, the number word applied to the last object counted represents the total amount.
Commutative Property of addition	A property of real numbers that states that the sum of two terms is unaffected by the order in which the terms are added; i.e., the sum remains the same. Example: $5 + 9 = 9 + 5$
Commutative Property of multiplication	A property of real numbers that states that the product of two factors is unaffected by the order in which the factors are multiplied, i.e., the product remains the same. Example: $5 \bullet 9 = 9 \bullet 5$
Composite	A number with more than two factors.
Composite Shape	Shapes composed of two or more shapes.
Congruent	Identical in form
Coordinate	An ordered pair of numbers in the form (*x, y*) that describes the location of a point on a coordinate plane.
Coordinate Plane	A plane divided by perpendicular number lines creating four quadrants. The perpendicular number lines represent the axes and where they intersect represents the origin (0,0). Points can be identified using coordinates (x,y) found within the quadrants (example below).

Glossary	
	
Counting Back	A strategy for finding the difference using backward counting. For example, if a stack of books has 12 books and someone borrows 4 books to read, how many books are left? A student may start at 12 and count back for spaces or numbers saying 12…11, 10, 9, 8; there are 8 books left in the stack.
Counting On	A strategy for finding the number of objects in a group without having to count every member of the group. For example, if a stack of books has 8 books and 3 more books are added to the top, it is unnecessary to count the stack all over again. One can find the total by *counting on* pointing to the top book and saying "eight", following this with "nine, ten, eleven." There are eleven books now.
Data Set	A collection of numbers related to a topic.
Decompose	Breaking a quantity into smaller quantities/units in order to assist computation.
Denominator	The term of a fraction, usually written under the line, that indicates the number of equal parts into which the unit is divided; divisor
Difference	The distance between two values; result of a subtraction problem.
Distributive Property	When a single-term expression is being multiplied by a sum or difference, the single-term expression can be multiplied by each term before finding the sum or difference. Examples: $3(7 + 5) = 3 \bullet 7 + 3 \bullet 5$ $w(5 - 2) = 5w - 2w$
Dividend	A number that is being divided by another number (divisor)
Divisor	The number by which another number is being divided
Equation	A statement that has one number or expression equal to another number or expression, such as 8 + 3 = 11 or 2x- 3 = 7.
Evaluate	Calculate or solve

Glossary	
Expanded form	A multi-digit number is expressed in expanded form when it is written as a sum of the single-digit multiples of powers of ten. For example, 643 = 600 + 40 + 3
Exponent	A symbol that is written above and to the right of a number to show how many times the number is to be multiplied by itself
Expression	A mathematical phrase consisting of numbers, variables, and operations
Fluency	There are different types of ***fluency***. All of them require students to be accurate, efficient, and flexible. The types are defined as follows: <u>Basic fact fluency</u> - fluency with operations involving single digit numbers. <u>Computational fluency</u> - having efficient and accurate methods for computing. Students exhibit computational fluency when they demonstrate flexibility in the computational methods they choose, understand, and can explain these methods as well as produce accurate answers efficiently. <u>Procedural fluency</u> - Procedural fluency is the ability to apply procedures accurately, efficiently, and flexibly; to transfer procedures to different problems and contexts; to build or modify procedures from other procedures, and to recognize when one strategy or procedure is more appropriate to apply than another. (NCTM)
Factor	One or more numbers (or variables) that are multiplied together to get a product (5 and 2 are both factors because 5 • 2 =10)
Fraction	A number expressible in the form *a/b* where *a* is a whole number and *b* is a whole number. (The word fraction in these standards, K-5, always refers to a non-negative number.) This includes all forms of fractions - fractions less than one, fractions greater than one (improper fractions), and mixed numbers. *See also*: rational number
Identity property of 0	The property that asserts the sum of an original addend plus zero is equal to the original addend. Example: $58 + 0 = 58$
Identity property of 1	The property that asserts the product of an original factor times one is equal to the original factor. Example: $58 \bullet 1 = 58$
Inequality Symbols	Symbols used to show a comparison between quantities. Also known as the greater than and less than symbols (<,>).
Interval	Includes all the numbers that come between two particular numbers.
Inverse (Operation)	An operation that is the opposite of, or undoes, another operation. Addition and subtraction are inverse operations as are multiplication and division.
Iterating	Repeating; repetition of a process in order to generate a sequence of outcomes.
Line plot	A method of visually displaying a distribution of data values where each data value is shown as an X or mark above a number line. Also known as a dot plot.
Mass	The amount of matter in an object. Often measured by the amount of material it contains which causes it to have weight. However, mass is not to be confused with weight. Weight is determined by the force of gravity on an object while mass is not.

Glossary	
	For example, an watermelon on Jupiter would have a greater weight than one on Earth because Jupiter's gravity is stronger than Earth's. The mass of the watermelon would be the same on both planets.
Mastery	Refers to teaching in a way that students learn to develop a deep understanding of mathematical concepts rather than memorizing key procedures or resorting to rote learning of steps or facts.
Multiplicative Comparison	Compare two amounts by asking how many times larger or smaller is one amount than the other.
Multiplicative inverses	Two numbers whose product is 1 are multiplicative inverses of one another. Examples: 3/4 and 4/3 are multiplicative inverses of one another because 3/4 • 4/3 = 1 6 and $\frac{1}{6}$ are also multiplicative inverses because $6 \bullet \frac{1}{6}$ = 1
Natural Numbers	Counting numbers 1, 2, 3, 4, 5, 6…
Number line diagram	A diagram of the number line used to represent numbers and support reasoning about them. In a number line diagram for measurement quantities, the interval from 0 to 1 on the diagram represents the unit of measure for the quantity.
Numerator	The number in a fraction that is above the fraction line and that is divided by the number below the fraction line.
Order of Operations	A specific sequence in which operations are to be performed when an expression requires more than one operation.
Origin	The point in a Cartesian coordinate system where axes intersect.
Place value	The value of the place of a digit in a numeral; the relative worth of each number that is determined by its position.
Polygons	A closed two-dimensional figure made up of straight sides.
Prime	A number with only two factors, 1 and itself.
Prism	A three-dimensional (solid) figure that has two congruent and parallel faces that are polygons called bases. The remaining faces, called lateral faces, are parallelograms (often rectangles). Prisms are named by the shape of their bases.
Product	The number or expression resulting from the multiplication together of two or more numbers or expressions (factor • factor = product)
Properties of operations	Rules that apply to the operations with real numbers. (See Table 1 below)
Quadrant	One of the four sections of a coordinate plane separated by horizontal and vertical axes.

Glossary	
	
Quotient	The number that results when one number is divided by another
Rational Numbers	A real number which can be written in the form $\frac{a}{b}$, where a and b are integers and $b \neq 0$. The set of rational numbers include the set of integers.
Rectangular array	A set of quantities arranged in rows and columns
Rectangular Prism	A three-dimensional figure whose six faces are rectangles.
Rectilinear Figures	A polygon with all right angles.
Subitize	Instantly see how many objects are in a group without counting.
Sum	The result of adding two or more numbers
Trapezoid	A quadrilateral with *at least* one pair of parallel sides
Unit fraction	A fraction where the numerator is 1 and the denominator is the positive integer
Value	Numerical worth or amount
Variable	A symbol used to represent an unknown value, usually a letter such as x
Vertices	A point where two or more line segments meet. (vertex is singular, plural is vertices)
Visual fraction model	A tape diagram, number line diagram, or area model
Volume	Amount of space occupied by a 3D object, measured in cubic units
Whole numbers	The numbers 0, 1, 2, 3…..

Appendix

Table 1: Properties of Operations

Associative property of addition	(a + b) + c = a + (b + c)
Commutative property of addition	a + b = b + a
Additive identity property of 0	a + 0 = 0 + a = a
Existence of additive inverses	For every a there exists –a so that *a + (-a) = (-a)* + a = *0*
Associative property of multiplication	(a • b) • c = a • (b • c)
Commutative property of multiplication	a • b = b • a
Multiplicative identity property 1	a • 1 = 1a = a
Existence of multiplication inverses	For every a ≠ 0 there exists 1/*a* so that a • 1/a = 1/a • a = 1
Distributive property of multiplication over addition	a • (b + c) = a • b + a • c

Table 2: Properties of Equality

Reflexive property of equality	a = a
Symmetric property of equality	If a = b, then b = a.
Transitive property of equality	If a = b and b = c, then a = c.
Addition property of equality	If a = b, then a + c = b + c.
Subtraction property of equality	If a = b, then a – c = b – c.
Multiplication property of equality	If a = b, then a • c = b • c.
Division property of equality	If a = b and c ≠ 0, then a ÷ c = b ÷ c.
Substitution property of equality	If a = b, then b may be substituted for a in any expression containing a.

Table 3: Properties of Inequality

Exactly one of the following is true: a < b, a = b, a > b.
If a > b and b > c, then a > c.
If a > b, b < a.
If a > b, then a ± c > b ± c.
If a > b and c > 0, then a • c > b • c.
If a > b and c < 0, then a • c < b • c.
If a > b and c > 0, then a ÷ c > b ÷ c.
If a > b and c < 0, then a ÷ c < b ÷ c.

Table 4: Common Problem Types for Addition and Subtraction

	RESULT UNKNOWN	CHANGE UNKNOWN	START UNKNOWN
ADD TO	Two bunnies sat on the grass. Three more bunnies hopped there. How many bunnies are on the grass now? 2 + 3 = ?	Two bunnies were sitting on the grass. Some more bunnies hopped there. Then there were five bunnies. How many bunnies hopped over to the first two? 2 + ? = 5	Some bunnies were sitting on the grass. Three more bunnies hopped there. Then there were five bunnies. How many bunnies were on the grass before? ? + 3 =5
TAKE FROM	Five apples were on the table. I ate two apples. How many apples are on the table now?5-2 = ?	Five apples were on the table. I ate some apples. Then there were three apples. How many apples did I eat? 5 – ? = 3	Some apples were on the table. I ate two apples. Then there were three apples. How many apples were on the table before?? -2 = 3
	TOTAL UNKNOWN	**ADDEND UNKNOWN**	**BOTH ADDENDS UNKNOWN**
PUT TOGETHER / TAKE APART	Three red apples and two green apples are on the table. How many apples are on the table? 3 + 2 = ?	Five apples are on the table. Three are red and the rest are green. How many apples are green? 3 + ? = 5, 5-3 = ?	Grandma has five flowers. How many can she put in the red vase and how many in her blue vase? 5 = 0 + 5, 5 + 0 5 = 1 +4, 5 = 4 +1 5 = 2 + 3, 5 = 3 + 2
COMPARE	**DIFFERENCE UNKNOWN**	**BIGGER UNKNOWN**	**SMALLER UNKNOWN**
	("How many more?" version):Lucy has two apples. Julie has five apples. How many more apples does Julie have than Lucy?("How many fewer?" version): Lucy has two apples. Julie has five apples. How many fewer apples does Lucy have then Julie? 2 + ? = 5, 5 – 2 = ?	(Version with "more"): Julie has three more apples than Lucy. Lucy has two apples. How many apples does Julie have? (Version with "fewer"): Lucy has 3 fewer apples than Julie. Lucy has two apples. How many apples does Julie have? 2 + 3 = ?, 3 + 2 = ?	(Version with "more"):Julie has three more apples than Lucy. Julie has five apples. How many apples does Lucy have?(Version with "fewer"): Lucy has 3 fewer apples than Julie. Julie has five apples. How many apples does Lucy have? 5 – 3 = ?, ? + 3 = 5

Table 5: Common Problem Types for Multiplication and Division

	UNKNOWN PRODUCT	GROUP SIZE UNKNOWN ("HOW MANY IN EACH GROUP?" DIVISION)	NUMBER OF GROUPS UNKNOWN ("HOW MANY GROUPS?" DIVISION)
	3 • 6 = ?	3 • ? = 18, and 18 ÷ 3 = ?	? • 6 = 18, and 18 ÷ 6 = ?
EQUAL GROUPS	There are 3 bags with 6 plums in each bag. How many plums are there in all? *Measurement example.* You need 3 lengths of string, each 6 inches long. How much string will you need altogether?	If 18 plums are shared equally into 3 bags, then how many plums will be in each bag? *Measurement example.* You have 18 inches of string, which you will cut into 3 equal pieces. How long will each piece of string be?	If 18 plums are to be packed 6 to a bag, then how many bags are needed? *Measurement example.* You have 18 inches of string, which you will cut into pieces that are 6 inches long. How many pieces of string will you have?
ARRAYS, AREA	There are 3 rows of apples with 6 apples in each row. How many apples are there? *Area example.* What is the area of a 3 cm by 6 cm rectangle?	If 18 apples are arranged into 3 equal rows, how many apples will be in each row? *Area example.* A rectangle has area 18 square centimeters. If one side is 3 cm long, how long is a side next to it?	If 18 apples are arranged into equal rows of 6 apples, how many rows will there be? *Area example.* A rectangle has area 18 square centimeters. If one side is 6 cm long, how long is a side next to it?
COMPARE	A blue hat costs \$6. A red hat costs 3 times as much as the blue hat. How much does the red hat cost? *Measurement example.* A rubber band is 6 cm long. How long will the rubber band be when it is stretched to be 3 times as long?	A red hat costs \$18 and that is 3 times as much as a blue hat costs. How much does a blue hat cost? *Measurement example.* A rubber band is stretched to be 18 cm long and that is 3 times as long as it was at first. How long was the rubber band at first?	A red hat costs \$18 and a blue hat costs \$6. How many times as much does the red hat cost as the blue hat? *Measurement example.* A rubber band was 6 cm long at first. Now it is stretched to be 18 cm long. How many times as long is the rubber band now as it was at first?
GENERAL	a • b = ?	a • ? = p and p ÷ a = ?	? • b = p, and p ÷ b = ?