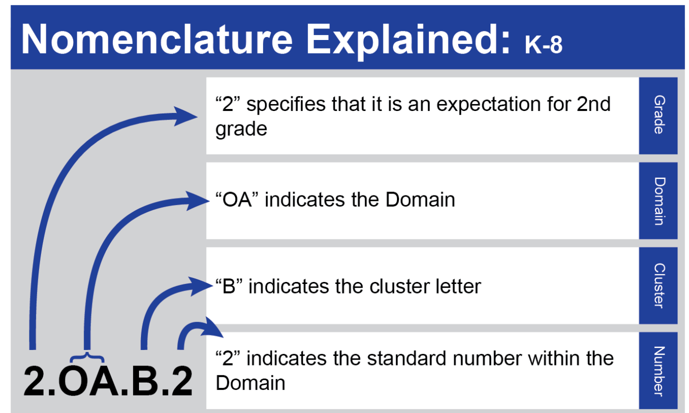
Arkansas Mathematics Standards
5th Grade
2022

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.

Fifth Grade Standards: Overview

Abbreviations: The following abbreviations are for the domains for the Arkansas Mathematics Standards.

Operations and Algebraic Thinking – OA

- Write and interpret numerical expressions
- Analyze patterns and relationships

Number and Operations in Base Ten – NBT

- Understand the place value system

Number and Operations – Fractions – NF

- Use equivalent fractions as a strategy to add and subtract fractions
- Apply and extend previous understandings of multiplication and division

Measurement and Data – MD

- Convert like measurement units within a given measurement system
- Represent and interpret data
- Understand concepts of volume

Geometry – G

- Graph points on the coordinate plane to solve real world and mathematical problems
- Classify 2D figures into categories based on their properties

3 - 5 Grade Band Teacher Note:

Multiplication is represented with the • symbol instead of an x. This is to eliminate confusion between the multiplication symbol and the variable x.

Operations and Algebraic Thinking

Cluster A: Write and interpret numerical expressions.

AR.Math.Content.5.OA.A.1

Use parentheses and/or brackets in numerical *expressions*, and *evaluate expressions* with these symbols (Order of Operations).

Teacher Note: *Expressions* should not include exponents unless the base is ten.
Examples: $(8 + 7) \bullet 2$, $[(6 \bullet 30) + (6 \bullet 7)]$, $3(4 + 7) + 5$

AR.Math.Content.5.OA.A.2

Write simple expressions that record calculations with numbers and interpret numerical *expressions* without evaluating them.

Teacher Note:
Example: Express the calculation 'add 8 and 7, then multiply by 2' as 2 • (8 + 7). Recognize that 3 • (18932 + 921) is three times as large as 18932 + 921, without having to calculate the indicated *sum* or *product.*

Cluster B: Analyze patterns and relationships.

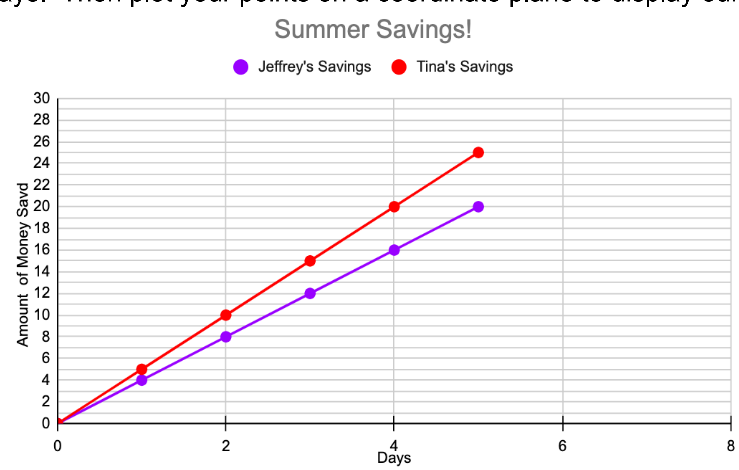
AR.Math.Content.5.OA.B.3

Analyze number patterns:

- Generate two numerical patterns, each using a given rule.
- Identify apparent relationships between corresponding terms by completing a function table or input/output table.
- Using the terms created, form, and graph ordered pairs in the first *quadrant* of the *coordinate plane.*

Teacher Note: Terms of the numerical patterns should be limited to *whole number coordinates*.
Example:
Jeffrey and Tina both get a piggy bank to save their summer savings. Jeffrey $4 a day. Tina earns $5 dollars per day. Create a table showing how much money they both save in 5 days. Then plot your points on a coordinate plane to display our pints as a line graph and interpret the data.

Days	Jeffrey's Savings	Tina's Savings
0	$0	$0
1	$4	$5
2	$8	$10
3	$12	$15
4	$16	$20
5	$20	$25



The rule for Jeffrey is add $4 per day. The rule for Tina is add $5 per day.

Number and Operations in Base Ten	
Cluster A: Understand the place value system.	
AR.Math.Content.5.NBT.A.1	Recognize that in a multi-digit number, a digit in a given place represents 10 times as much as it represents in the place to its right and 1/10 of what it represents in the place to its left.
AR.Math.Content.5.NBT.A.2	Understand why multiplying or dividing by a power of 10 shifts the *value* of the digits of a *whole number* or decimal. ● Explain patterns in the number of zeros of the *product* when multiplying a *whole number* by powers of 10. ● 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.
AR.Math.Content.5.NBT.A.3	Read, write, and compare decimals to thousandths: ● Read and write decimals to thousandths using base ten numerals, number names, and *expanded form(s).* ● Compare two decimals to thousandths based on the *value* of the digits in each place, using (>, =, <) symbols to record the results of comparisons. Teacher Note: Teachers and students should use the correct terminology of symbols, including *inequality symbols*, to record the results of comparisons. Examples: ● Base ten numerals “standard form” (347.392) ● Number name form or word form (three-hundred forty seven and three hundred ninety-two thousandths) ● *Expanded form*(s): 300 + 40 + 7 + .3 + .09 +.002 = 300 +40 +7 +3/10 + 9/100 + 2/100 3 • 100 + 4 • 10 + 7 • 1 + 3 • (1/10) + 9 • (1/100) +2 • (1/1000) $3 \bullet 10^2 + 4 \bullet 10^1 \bullet 7 \bullet 10^0 + 3 \bullet (1/10^1) + 9 \bullet (1/10^2) + 2 \bullet (1/10^3)$
AR.Math.Content.5.NBT.A.4	Apply *place value* understanding to round decimals to any place up to the thousandths.

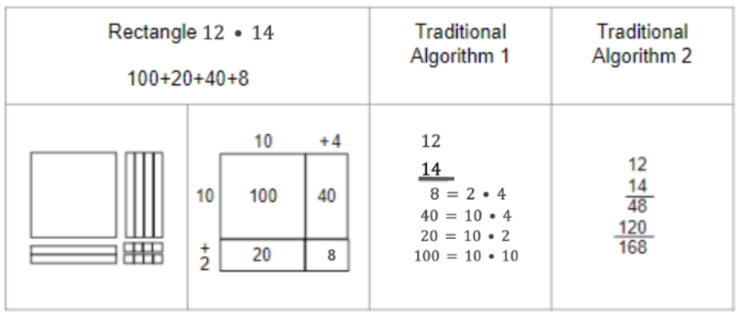
<table>
<tr><th colspan="2">Cluster B: Perform operations with multi-digit whole numbers and with decimals to hundredths.</th></tr>
<tr><td>AR.Math.Content.5.NBT.B.5</td><td>

Fluently (efficiently, accurately, and with some degree of flexibility) multiply multi-digit *whole numbers* using any standard base ten *algorithm.*

Teacher Note:

- The standard calls for *fluency* using a standard *algorithm*. Standard *algorithms* for base ten multiplication are based on decomposing numbers written in base ten notation. This allows multiplication of two, multi-digit *whole numbers* to be reduced to a collection of single digit computations.
- 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.

Example: 12 • 14 = 168



Specification: Students should demonstrate mastery of this standard by the end of 5th grade.

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<tr><td>AR.Math.Content.5.NBT.B.6</td><td>

Find whole number *quotients* of *whole numbers* with up to four-digit *dividends* and two-digit *divisors*.
Use strategies based on:

- *Place value*
- The *properties of operations*
- Divisibility rules
- The relationship between multiplication and division

Teacher Note: Students may illustrate and explain calculations by using *equations*, *rectangular arrays*, or area models.

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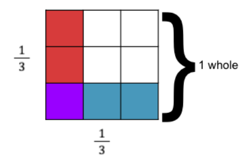
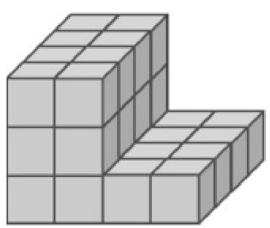
AR.Math.Content.5.NBT.B.7	Perform basic operations on decimals to the hundredths place, relate the strategy used to a written method, and explain the reasoning used. ● Add and subtract decimals to hundredths using concrete models or drawings and strategies based on *place value*, *properties of operations*, and the relationship between addition and subtraction. ● Multiply and divide decimals to hundredths using concrete models or drawings and strategies based on *place value*, *properties of operations*, and the relationship between multiplication and division. Teacher Note: Division of decimals will remain consistent with AR.Math.Content.5.NF.B.7. Meaning, divide a decimal by a *whole number* and a *whole number* by a decimal.

Number and Operations - Fractions	
Cluster A: Use equivalent fractions as a strategy to add and subtract fractions.	
AR.Math.Content.5.NF.A.1	Fluently (efficiently, accurately, and with some degree of flexibility) add and subtract *fractions* with unlike *denominators* (including mixed numbers) using equivalent *fractions* and common *denominators.* Teacher Note: Students may be expected to write the equivalent forms of the answer. Example: Understand that 2/3 + 5/4 = 8/12 + 15/12 = 23/12 and 1 11/12 (In general, a/b + c/d = (ad + bc)/bd). Specification: Students should demonstrate *mastery* of this standard by the end of 5th grade.
AR.Math.Content.5.NF.A.2	Solve fraction word problems. ● Solve word problems involving addition and subtraction of *fractions* referring to the same whole, including cases of unlike *denominators.* ● Use benchmark *fractions* and number sense of *fractions* to estimate mentally and assess the reasonableness of answers (e.g., Use benchmark fractions to recognize an incorrect result 2/5 + 1/2 = 3/7, by observing that 3/7 < 1/2). Teacher Note: Use *visual fraction models* or *equations* to represent the problem.

Cluster B: Apply and extend previous understandings of multiplication and division.	
AR.Math.Content.5.NF.B.3	Understand fractions as division problems. ● Interpret a *fraction* (greater than one or less than one) as division of the *numerator* by the *denominator* (**a/b = a ÷ b**), where **a** and **b** are *natural numbers* (e.g., Interpret 3/4 as the result of dividing 3 by 4, noting that 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 3/4, including *fractions* greater than one (5/4 = 1 1/4). ● Solve word problems involving division of *natural numbers* leading to answers in the form of *fractions* or mixed numbers (e.g., Use *visual fraction models* or *equations* to represent the problem. 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 the answer lie?).
AR.Math.Content.5.NF.B.4	Apply and extend previous understandings of multiplication to multiply a *fraction* or *whole number* by a *fraction*: ● Interpret the *product* (**a/b**) • **q** as *a* part of a partition of **q** into **b** equal parts; equivalently, as the result of a sequence of operations **a • q ÷ b** *(e.g.,* Use a *visual fraction model* to show (2/3) × 12 means to take 12 and divide it into thirds (1/3 of 12 is 4) and take two of the parts (2 • 4 is 8), so (2/3) • 12 = 8. Do the same with (2/3) • (4/5) = 8/15. (In general, **(a/b) • (c/d) = ac/bd).** ● Find the area of a rectangle with fractional and/or mixed number side lengths, by tiling it with unit squares of the appropriate *unit fraction* side lengths, by multiplying the fractional side lengths, and then show that both procedures yield the same area.  Teacher Note: Example: $\frac{1}{3}$ of $\frac{1}{3} = \frac{1}{3} \bullet \frac{1}{3} = \frac{1}{9}$
AR.Math.Content.5.NF.B.5	Interpret multiplication as scaling (resizing equally) 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 (e.g., Understand that 2/3 is twice as large as 1/3 because 1/3 • 2 = 2/3). ● Explain why multiplying a given number by a *fraction* greater than 1 results in a *product* greater than the given number. ● Explain why multiplying a given number by a *fraction* less than 1 results in a *product* smaller than the given number. ● Relate the principle of *fraction* equivalence **a/b = (n • a)/(n • b)** to the effect of multiplying **a/b** by 1. Teacher Note: Teachers and students should use the correct terminology of symbols to record the results of comparisons.
AR.Math.Content.5.NF.B.6	Solve and create real world problems involving multiplication of *fractions* and mixed numbers. Teacher Note: Use *visual fraction models* or *equations* to represent the problem.

AR.Math.Content.5.NF.B.7	Apply and extend previous understandings of division to divide *unit fractions* by *whole numbers* and *whole numbers* by *unit fractions*: ● Interpret division of a *unit fraction* by a natural number, and compute such *quotients (e.g.,* Create a story context for (1/3) ÷ 4, and use a *visual fraction model* to show the *quotient*. Use the relationship between multiplication and division to explain that (1/3) ÷ 4 = 1/12 because (1/12) • 4 = 1/3). ● Interpret division of a *whole number* by a *unit fraction*, and compute such *quotients (e.g.,* Create a story context for 4 ÷ (1/5), and use a *visual fraction model* to show the *quotient*. Use the relationship between multiplication and division to explain that 4 ÷ (1/5) = 20 because 20 • (1/5) = 4). ● Solve real world problems involving division of *unit fractions* by natural numbers and division of *whole numbers* by *unit fractions (e.g.,* Use *visual fraction models* and *equations* to represent the problem. How much chocolate will each person get if 3 people share 1/2 lb of chocolate equally? How many 1/3-cup servings are in 2 cups of raisins?). Teacher Note: Students able to multiply *fractions*, in general, can develop strategies to divide *fractions* by reasoning about the relationship between multiplication and division. This grade does not require division of a fraction by a fraction.

Measurement and Data	
Cluster A: Convert like measurement units within a given measurement system.	
AR.Math.Content.5.MD.A.1	Solve measurement conversions. ● Convert among different-sized standard measurement units within the <u>metric system</u> (e.g., Convert 5 cm to 0.05 m). ● Convert among different-sized standard measurement units within the <u>customary system</u> (e.g., Convert 1 ½ ft to 18 in). ● Use these conversions in solving multi-step, real world problems. Teacher Note: A conversion chart is recommended. Students are not expected to recall conversions from memory.
Cluster B: Represent and interpret data.	
AR.Math.Content.5.MD.B.2	Create and interpret line plots. ● Make a line plot to display a data set of measurements in fractions of a unit (1/2, 1/4, 1/8). ● Use all operations on fractions to solve problems involving information presented in line plots. Teacher Note: *Fraction* by *fraction* division is not a fifth grade expectation. 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.

Cluster C: Geometric measurement: Understand concepts of volume.	
AR.Math.Content.5.MD.C.3	Recognize *volume* as an *attribute* of solid figures and understand concepts of *volume* measurement. (e.g., Using rectangular prisms, spheres, cylinders). ● A cube with a side length of 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, has a *volume* of **n** cubic units. Teacher Note: Students should be expected to build conceptual understanding of *volume* with *rectangular prisms* for further work in this grade level.
AR.Math.Content.5.MD.C.4	Measure *volumes* by counting unit cubes using cubic cm (cm^3), cubic in (in^3), cubic ft (ft^3) , and improvised units (u^3).
AR.Math.Content.5.MD.C.5	Relate *volume* to the operations of multiplication and addition, solve real world mathematical problems involving *volume*. ● Find 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 (B). ● Represent threefold whole number *products* as *volumes* (e.g., To represent the *Associative Property of Multiplication*). ● Apply the formulas ($V = l \bullet w \bullet h$ or $V = B \bullet h$) 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. ● Recognize *volume* as additive. Find *volumes* of solid figures composed of two non-overlapping right *rectangular prisms* by adding the *volumes* of the non-overlapping parts, applying this technique to solve real world problems. Teacher Note: Examples: John found the *volume* of the figure below. He decided to break it apart into two separate rectangular prisms. John found the *volume* of the solid below using this *expression*: (4 • 4 • 1) + (2 • 4 • 2). *Decompose* the figure into two rectangular prisms and shade them in different colors to show one way John might have thought about it. Mai also broke this solid into two rectangular prisms, but she did it differently than John. She found the *volume* of the solid below using this *expression*: (2 • 4 • 3) + (2 • 4 • 1). *Decompose* the figure into two *rectangular prisms* and shade them in different colors to show one way Mai might have thought about it. 

<table>
<tr><th colspan="2">Geometry</th></tr>
<tr><th colspan="2">Cluster A: Graph points on the coordinate plane to solve real-world and mathematical problems.</th></tr>
<tr><td>AR.Math.Content.5.G.A.1</td><td>Graph and identify coordinates.
● 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 x-axis (horizontal). The second number indicates how far to travel in the direction of the y-axis (vertical). Write the coordinates using the names of the two axes and the coordinates that correspond (e.g., x-axis and x-coordinate, y-axis and y-coordinate).

Teacher Note: Graphing should be limited to the first quadrant.</td></tr>
<tr><td>AR.Math.Content.5.G.A.2</td><td>Graph on the coordinate plane.
● Represent real world and mathematical problems by graphing points in the first quadrant on coordinate plane.
● Interpret coordinate values of points in the context of the situation.

Teacher Note:
Examples:
(1) Beth has saved $50. She earns $9 for each hour she works.
● If Beth saves all of her money, how much will she have after working for 4 hours? 6 hours? 12 hours?
● Create a graph to show the relationship between the hours Beth worked and the amount of money she has saved.
● What else can you learn from analyzing the graph?
(2) Use the graph below to find how much money Joseph makes after working 18 hours.

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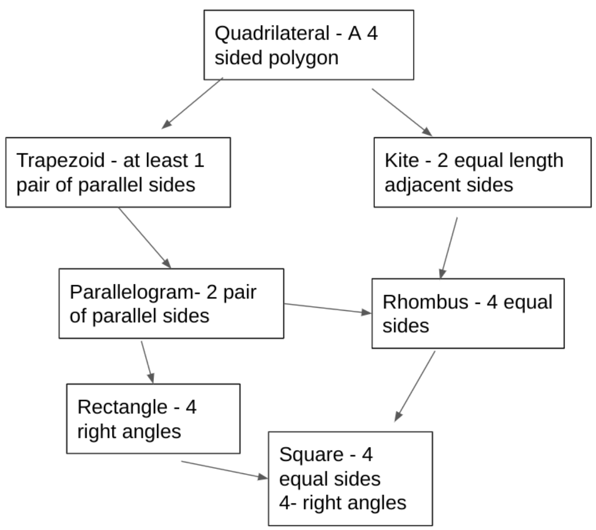
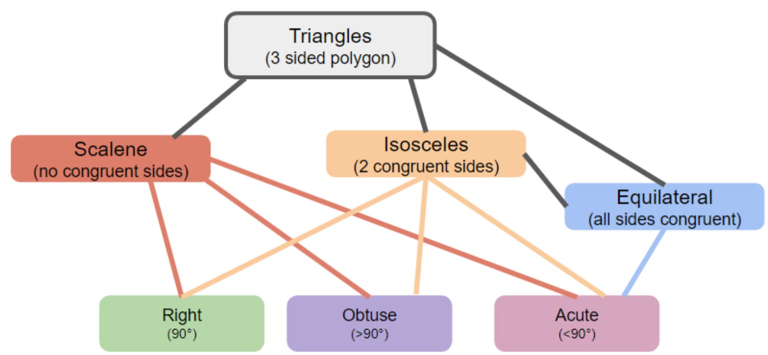
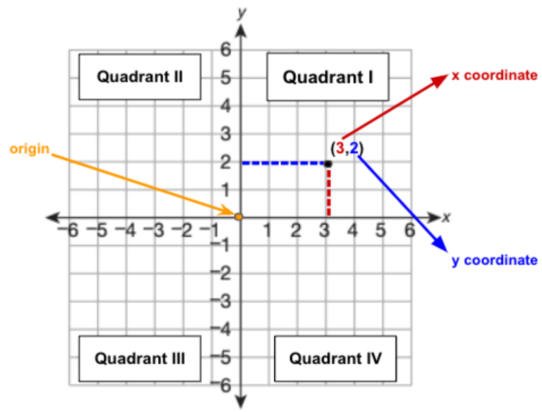
Cluster B: Classify two-dimensional figures into categories based on their properties.	
AR.Math.Content.5.G.B.3	Understand that *attributes* belonging to a category of 2D figures also belong to all subcategories of that category. Teacher Note: Compare shapes using always, sometimes, and never. Example: ● All rectangles have four right angles and squares are rectangles, so all squares have four right angles. ● All isosceles triangles have at least two *congruent* sides and equilateral triangles are isosceles. Therefore, equilateral triangles have at least two *congruent* sides.
AR.Math.Content.5.G.B.4	Classify 2D figures in a hierarchy based on properties with the focus on quadrilaterals and triangles when teaching hierarchies. Shapes to include: ● Quadrilaterals - *trapezoid*, parallelogram, rectangle, square, rhombus, kite ● Triangles - right, acute, obtuse, scalene, isosceles, and equilateral Teacher Note: *Trapezoids* are defined to be a quadrilateral with at least one pair of opposite sides parallel. Therefore, all parallelograms are *trapezoids*. The figures below show the hierarchy of quadrilaterals (Figure 1) & hierarchy of triangles (Figure 2).  Figure 1: Hierarchy of Quadrilaterals  Figure 2: Hierarchy of Triangles

K-5 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).

K-5 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
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

K-5 Glossary	
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: Basic fact fluency - fluency with operations involving single digit numbers. Computational fluency - 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. Procedural fluency - 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. 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.

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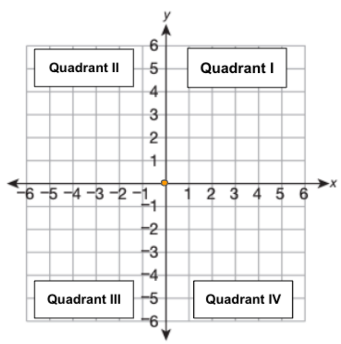
Multiplicative Comparison	Compare two amounts by asking how many times larger or smaller is one amount than the other.
Multiplicative inverses	Two numbers whose product is 1 are multiplicative inverses of one another. Examples: 3/4 and 4/3 are multiplicative inverses of one another because 3/4 • 4/3 = 1 6 and $\frac{1}{6}$ are also multiplicative inverses because 6 • $\frac{1}{6}$ = 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. 
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.

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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 = ?