GRADE: K

Domain-Subdomain: COUNTING AND CARDINALITY	
Cluster 1: Know number names and the count sequence. (Major Cluster) Clusters should not be sorted from Major to Supporting and then taught in that order. To do so would strip the coherence of the mathematical ideas and miss the opportunity to enhance the major work of the grade with the supporting clusters.	
STANDARD CODE	**STANDARD**
MAFS.K.CC.1.1	Count to 100 by ones and by tens. *Content Complexity:* Level 1: Recall
MAFS.K.CC.1.2	Count forward beginning from a given number within the known sequence (instead of having to begin at 1). *Content Complexity:* Level 1: Recall
MAFS.K.CC.1.3	Read and write numerals from 0 to 20. Represent a number of objects with a written numeral 0 20 (with 0 representing a count of no objects). *Content Complexity:* Level 1: Recall

Cluster 2: Count to tell the number of objects. (Major Cluster) Clusters should not be sorted from Major to Supporting and then taught in that order. To do so would strip the coherence of the mathematical ideas and miss the opportunity to enhance the major work of the grade with the supporting clusters.	
STANDARD CODE	**STANDARD**
MAFS.K.CC.2.4	Understand the relationship between numbers and quantities; connect counting to cardinality. a. When counting objects, say the number names in the standard order, pairing each object with one and only one number name and each number name with one and only one object. b. Understand that the last number name said tells the number of objects counted. The number of objects is the same regardless of their arrangement or the order in which they were counted. c. Understand that each successive number name refers to a quantity that is one larger. *Content Complexity:* Level 1: Recall
MAFS.K.CC.2.5	a rectangular array, or a circle, or as many as 10 things in a scattered configuration; given a number from 1 20, count out that many objects. *Content Complexity:* Level 1: Recall

Cluster 3: Compare numbers. (Major Cluster)

Clusters should not be sorted from Major to Supporting and then taught in that order. To do so would strip the coherence of the mathematical ideas and miss the opportunity to enhance the major work ofdeaororu453dho 64(w)5(i)5(t)-4h sthe porting luat-6(rs.)] TJETQq72.744 679.3 46

MAFS.K.NBT.1.1	Compose and decompose numbers from 11 to 19 into ten ones and some further ones, e.g., by using objects or drawings, and record each composition or decomposition by a drawing or equation (e.g., 18 = 10 + 8); understand that these numbers are composed of ten ones and one, two, three, four, five, six, seven, eight, or nine ones. *Content Complexity:* Level 2: Basic Application of Skills & Concepts

Domain-Subdomain: MEASUREMENT AND DATA

Cluster 1: Describe and compare measurable attributes. (Additional Cluster)

Clusters should not be sorted from Major to Supporting and then taught in that order. To do so would strip the coherence of the mathematical ideas and miss the opportunity to enhance the major work of the grade with the supporting clusters.

STANDARD CODE	STANDARD
MAFS.K.MD.1.1	Describe measurable attributes of objects, such as length or weight. Describe several measurable attributes of a single object. *Content Complexity:* Level 2: Basic Application of Skills & Concepts
MAFS.K.MD.1.2	Directly compare two objects with a measurable attribute in common, to see which *For example, directly compare the heights of two children and describe one child as taller/shorter.* *Content Complexity:* Level 2: Basic Application of Skills & Concepts
MAFS.K.MD.1.a	Express the length of an object as a whole number of length units, by laying multiple copies of a shorter object (the length unit) end to end; understand that the length measurement of an object is the number of same-size length units that span it with no gaps or overlaps. *Limit to contexts where the object being measured is spanned by a whole number of length units with no gaps or overlaps.*

Cluster 2: Classify objects and count the number of objects in each category. (Supporting Cluster)

Clusters should not be sorted from Major to Supporting and then taught in that order. To do so would strip the coherence of the mathematical ideas and miss the opportunity to enhance the major work of the grade with the supporting clusters.

STANDARD CODE	STANDARD
MAFS.K.MD.2.3	Classify objects into given categories; count the numbers of objects in each category and sort the categories by count. *Content Complexity:* Level 2: Basic Application of Skills & Concepts

Domain-Subdomain: GEOMETRY

Cluster 1: Identify and describe shapes (squares, circles, triangles, rectangles, hexagons, cubes, cones, cylinders, and spheres). (Additional Cluster)

Clusters should not be sorted from Major to Supporting and then taught in that order. To do so would strip the coherence of the mathematical ideas and miss the opportunity to enhance the major work of the grade with the supporting clusters.

STANDARD CODE	STANDARD
MAFS.K.G.1.1	Describe objects in the environment using names of shapes, and describe the relative positions of these objects using terms such as *above, below, beside, in front of, behind, and next to.*

	Content Complexity: Level 2: Basic Application of Skills & Concepts
MAFS.K.G.1.2	Correctly name shapes regardless of their orientations or overall size. *Content Complexity:* Level 1: Recall
MAFS.K.G.1.3	Identify shapes as two- -dimensional *Content Complexity:* Level 1: Recall

Cluster 2:

Cluster 2: Understand and apply properties of operations and the relationship between addition and subtraction. (Major Cluster)

Clusters should not be sorted from Major to Supporting and then taught in that order. To do so would strip the coherence of the mathematical ideas and miss the opportunity to enhance the major work of the grade with the supporting clusters.

STANDARD CODE	STANDARD
MAFS.1.OA.2.3	Apply properties of operations as strategies to add and subtract. *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.)* *Content Complexity:* Level 2: Basic Application of Skills & Concepts
MAFS.1.OA.2.4	Understand subtraction as an unknown-addend problem. *For example, subtract 10 8 by finding the number that makes 10 when added to 8.* *Content Complexity:* Level 2: Basic Application of Skills & Concepts

Cluster 3: Add and subtract within 20. (Major Cluster)

Clusters should not be sorted from Major to Supporting and then taught in that order. To do so would strip the coherence of the mathematical ideas and miss the opportunity to enhance the major work of the grade with the supporting clusters.

STANDARD CODE	STANDARD
MAFS.1.OA.3.5	Relate counting to addition and subtraction (e.g., by counting on 2 to add 2). *Content Complexity:* Level 1: Recall
MAFS.1.OA.3.6	[redacted]

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MAFS.1.NBT.3.6	Subtract multiples of 10 in the range 10-90 from multiples of 10 in the range 10-90 (positive or zero differences), using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used. *Content Complexity:* Level 2: Basic Application of Skills & Concepts

Domain-Subdomain: MEASUREMENT AND DATA

Cluster 1: Measure lengths indirectly and by iterating length units. (Major Cluster)

Clusters should not be sorted from Major to Supporting and then taught in that order. To do so would strip the coherence of the mathematical ideas and miss the opportunity to enhance the major work of the grade with the supporting clusters.

STANDARD CODE	STANDARD
MAFS.1.MD.1.1	Order three objects by length; compare the lengths of two objects indirectly by using a third object. *Content Complexity:* Level 2: Basic Application of Skills & Concepts
MAFS.1.MD.1.a	Understand how to use a ruler to measure length to the nearest inch. a. Recognize that the ruler is a tool that can be used to measure the attribute of length. b. Understand the importance of the zero point and end point and that the length measure is the span between two points. c. Recognize that the units marked on a ruler have equal length intervals and fit together with no gaps or overlaps. These equal interval distances can be counted to determine the overall length of an object. *Content Complexity:* Level 2: Basic Application of Skills & Concepts

Cluster 2: Work with time and money. (Additional Cluster)

Clusters should not be sorted from Major to Supporting and then taught in that order. To do so would strip the coherence of the mathematical ideas and miss the opportunity to enhance the major work of the grade with the supporting clusters.

STANDARD CODE	STANDARD
MAFS.1.MD.2.3	Tell and write time in hours and half-hours using analog and digital clocks. *Content Complexity:* Level 1: Recall
MAFS.1.MD.2.a	Identify and combine values of money in cents up to one dollar working with a single unit of currency[1]. a.

Cluster 3: Represent and interpret data. (Supporting Cluster)

Clusters should not be sorted from Major to Supporting and then taught in that order. To do so would strip the coherence of the mathematical ideas and miss the opportunity to enhance the major work of the grade with the supporting clusters.

STANDARD CODE	STANDARD

MAFS.2.OA.1.a	Determine the unknown whole number in an equation relating four or more whole numbers. For example, determine the unknown number that makes the equation true in the equations 37 + 10 + 10 = _____ + 18, ? 6 = 13 4, and 15 9 = 6 + . *Content Complexity:* Level 2: Basic Application of Skills & Concepts

Cluster 2: Add and subtract within 20. (Major Cluster)

	Content Complexity: Level 2: Basic Application of Skills & Concepts
MAFS.2.NBT.1.2	Count within 1000; skip-count by 5s, 10s, and 100s. *Content Complexity:* Level 1: Recall
MAFS.2.NBT.1.3	Read and write numbers to 1000 using base-ten numerals, number names, and expanded form. *Content Complexity:* Level 1: Recall
MAFS.2.NBT.1.4	Compare two three-digit numbers based on meanings of the hundreds, tens, and ones digits, using >, =, and < symbols to record the results of comparisons. *Content Complexity:* Level 2: Basic Application of Skills & Concepts

Cluster 2: Use place value understanding and properties of operations to add and subtract. (Major Cluster)

Clusters should not be sorted from Major to Supporting and then taught in that order. To do so would strip the coherence of the mathematical ideas and miss the opportunity to enhance the major work of the grade with the supporting clusters.

STANDARD CODE	STANDARD
MAFS.2.NBT.2.5	Fluently add and subtract within 100 using strategies based on place value, properties of operations, and/or the relationship between addition and subtraction. *Content Complexity:* Level 1: Recall
MAFS.2.NBT.2.6	Add up to four two-digit numbers using strategies based on place value and properties of operations. *Content Complexity:* Level 1: Recall
MAFS.2.NBT.2.7	Add and subtract within 1000, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method. Understand that in adding or subtracting three digit numbers, one adds or subtracts hundreds and hundreds, tens and tens, ones and ones; and sometimes it is necessary to compose or decompose tens or hundreds. *Content Complexity:* Level 2: Basic Application of Skills & Concepts
MAFS.2.NBT.2.8	Mentally add 10 or 100 to a given number 100 900, and mentally subtract 10 or 100 from a given number 100 900. *Content Complexity:* Level 1: Recall
MAFS.2.NBT.2.9	Explain why addition and subtraction strategies work, using place value and the properties of operations. *Content Complexity:* Level 3: Strategic Thinking & Complex Reasoning

Domain-Subdomain: MEASUREMENT AND DATA

Cluster 1: Measure and estimate lengths in standard units. (Major Cluster)

Clusters should not be sorted from Major to Supporting and then taught in that order. To do so would strip the coherence of the mathematical ideas and miss the opportunity to enhance the major work of the grade with the supporting clusters.

STANDARD CODE	STANDARD

d.

Cluster 1: Represent and solve problems involving multiplication and division. (Major Cluster)

Clusters should not be sorted from Major to Supporting and then taught in that order. To do so would strip the coherence of the mathematical ideas and miss the opportunity to enhance the major work of the grade with the supporting clusters.

STANDARD CODE	STANDARD
MAFS.3.OA.1.1	Interpret products of whole numbers, e.g., interpret 5 × 7 as the total number of objects in 5 groups of 7 objects each. *For example, describe a context in which a total number of objects can be expressed as 5 × 7.* *Clarifications*: **Examples of Opportunities for In-Depth Focus** Word problems involving equal groups, arrays, and measurement quantities can be g of and skill with multiplication and division, as well as to allow students to demonstrate their understanding of and skill with these operations. *Content Complexity:* Level 1: Recall
MAFS.3.OA.1.2	Interpret whole-number quotients of whole numbers, e.g., interpret 56 ÷ 8 as the number of objects in each share when 56 objects are partitioned equally into 8 shares, or as a number of shares when 56 objects are partitioned into equal shares of 8 objects each. *For example, describe a context in which a number of shares or a number of groups can be expressed as 56 ÷ 8.* *Clarifications*: **Examples of Opportunities for In-Depth Focus** Word problems involving equal groups, arrays, and measurement quantities can be well as to allow students to demonstrate their understanding of and skill with these operations. *Content Complexity:* Level 1: Recall
MAFS.3.OA.1.3	Use multiplication and division within 100 to solve word problems in situations involving equal groups, arrays, and measurement quantities, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem. *Clarifications*: **Examples of Opportunities for In-Depth Focus** Word problems involving equal groups, arrays, and measurement quantities can be well as to allow students to demonstrate their understanding of and skill with these operations. *Content Complexity:* Level 2: Basic Application of Skills & Concepts
MAFS.3.OA.1.4	Determine the unknown whole number in a multiplication or division equation relating three whole numbers. *For example, determine the unknown number that makes the*

	equation true in each of the equations 8 × ? = 48, 5 = [] ÷ 3, 6 × 6 = ?. *Clarifications*: **Examples of Opportunities for In-Depth Focus** Word problems involving equal groups, arrays, and measurement quantities can be u well as to allow students to demonstrate their understanding of and skill with these operations. *Content Complexity:* Level 1: Recall

Cluster 2: Understand properties of multiplication and the relationship between multiplication and division. (Major Cluster)

Clusters should not be sorted from Major to Supporting and then taught in that order. To do so would strip the coherence of the mathematical ideas and miss the opportunity to enhance the major work of the grade with the supporting clusters.

STANDARD CODE	STANDARD

	understandings that support them are crucial; students will rely on them for years to come as they learn to multiply and divide with multidigit whole numbers and to add, subtract, multiply, and divide with fractions. After multiplication and division situations have been established, reasoning about patterns in products (e.g., products involving factors of 5 or 9) can help students remember particular products and quotients. Practice and if necessary, extra support should continue all year for those who need it to attain fluency. *Content Complexity:* Level 1: Recall

Cluster 4: Solve problems involving the four operations, and identify and explain patterns in arithmetic. (Major Cluster)

Clusters should not be sorted from Major to Supporting and then taught in that order. To do so would strip the coherence of the mathematical ideas and miss the opportunity to enhance the major work of the grade with the supporting clusters.

STANDARD CODE	STANDARD
MAFS.3.OA.4.8	Solve two-step word problems using the four operations. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding. *Content Complexity:* Level 2: Basic Application of Skills & Concepts
MAFS.3.OA.4.9	Identify arithmetic patterns (including patterns in the addition table or multiplication table), and explain them using properties of operations. *For example, observe that 4 times a number is always even, and explain why 4 times a number can be decomposed into two equal addends.* *Content Complexity:* Level 3: Strategic Thinking & Complex Reasoning

Domain-Subdomain: NUMBER AND OPERATIONS IN BASE TEN

Cluster 1: Use place value understanding and properties of operations to perform multi-digit arithmetic. (Additional Cluster)

Clusters should not be sorted from Major to Supporting and then taught in that order. To do so would strip the coherence of the mathematical ideas and miss the opportunity to enhance the major work of the grade with the supporting clusters.

STANDARD CODE	STANDARD
MAFS.3.NBT.1.1	Use place value understanding to round whole numbers to the nearest 10 or 100. *Content Complexity:* Level 1: Recall
MAFS.3.NBT.1.2	Fluently add and subtract within 1000 using strategies and algorithms based on place value, properties of operations, and/or the relationship between addition and subtraction. *Clarifications*: Students fluently add and subtract within 1000 using strategies and algorithms based on place value, properties of operations, and/or the relationship between addition and subtraction. (Although 3.OA.3.7 and 3.NBT.1.2 are both fluency standards, these two standards do not represent equal investments of time in grade 3. Note that students in grade 2 were already adding and subtracting within 1000, just not fluently. That makes 3.NBT.1.2 a relatively small and incremental expectation. By contrast, multiplication and division are new in grade 3, and meeting the multiplication and

	work in grade 3.) *Content Complexity:* Level 1: Recall
MAFS.3.NBT.1.3	Multiply one-digit whole numbers by multiples of 10 in the range 10 90 (e.g., 9 × 80, 5 × 60) using strategies based on place value and properties of operations. *Content Complexity:* Level 1: Recall

Domain-Subdomain: NUMBER AND OPERATIONS - FRACTIONS

	Area is a major concept within measurement, and area models must function as a support for multiplicative reasoning in grade 3 and beyond. *Content Complexity:* Level 3: Strategic Thinking & Complex Reasoning

Cluster 4:

	Content Complexity: Level 2: Basic Application of Skills & Concepts

Domain-Subdomain: NUMBER AND OPERATIONS IN BASE TEN	
Cluster 1: Generalize place value understanding for multi-digit whole numbers. (Major Cluster) Clusters should not be sorted from Major to Supporting and then taught in that order. To do so would strip the coherence of the mathematical ideas and miss the opportunity to enhance the major work of the grade with the supporting clusters.	
STANDARD CODE	**STANDARD**
MAFS.4.NBT.1.1	Recognize that in a multi-digit whole number, a digit in one place represents ten times what it represents in the place to its right. *For example, recognize that 700 ÷ 70 = 10 by applying concepts of place value and division.* *Content Complexity:* Level 1: Recall
MAFS.4.NBT.1.2	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. *Content Complexity:* Level 2: Basic Application of Skills & Concepts
MAFS.4.NBT.1.3	Use place value understanding to round multi-digit whole numbers to any place. *Content Complexity:* Level 1: Recall

Cluster 2: Use place value understanding and properties of operations to perform multi-digit arithmetic. (Major Cluster) Clusters should not be sorted from Major to Supporting and then taught in that order. To do so would strip the coherence of the mathematical ideas and miss the opportunity to enhance the major work of the grade with the supporting clusters.	
STANDARD CODE	**STANDARD**
MAFS.4.NBT.2.4	Fluently add and 9.38 338.69 0.72003 10.44 ref*539.38 6 93.24 re2003 10 93.24 reW* n

c. Add and subtract mixed numbers with like denominators, e.g., by replacing each mixed number with an equivalent fraction, and/or by using properties of operations and the relationship between addition and subtraction.
d. Solve word problems involving addition and subtraction of fractions referring to the same whole and having like denominators, e.g., by using visual fraction models and equations to represent the problem.

Clarifications:
Examples of Opportunities for In-Depth Focus

This standard represents an important step in the multi-grade progression for addition and subtraction of fractions. Students extend their prior understanding of addition and subtraction to add and subtract fractions with like denominators by thinking of adding or subtracting so many unit fractions.

Content Complexity:

MAFS.4.NF.3.6	Use decimal notation for fractions with denominators 10 or 100. *For example, rewrite 0.62 as 62/100; describe a length as 0.62 meters; locate 0.62 on a number line diagram.* *Content Complexity:* Level 1: Recall
MAFS.4.NF.3.7	Compare two decimals to hundredths by reasoning about their size. Recognize that comparisons are valid only when the two decimals refer to the same whole. Record the results of comparisons with the symbols >, =, or <, and justify the conclusions, e.g., by using a visual model. *Content Complexity:* Level 2: Basic Application of Skills & Concepts

Domain-Subdomain: MEASUREMENT AND DATA

Cluster 1: Solve problems involving measurement and conversion of measurements from a larger unit to a smaller unit. (Supporting Cluster)

Clusters should not be sorted from Major to Supporting and then taught in that order. To do so

	Content Complexity: Level 2: Basic Application of Skills & Concepts

Cluste

	Content Complexity: Level 2: Basic Application of Skills & Concepts
MAFS.4.G.1.3	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. *Content Complexity:* Level 2: Basic Application of Skills & Concepts

GRADE: 5

Domain-

MAFS.5.NBT.1.1	Recognize that in a multi-digit number, a digit in one place represents 10 times as much as it represents in the place to its right and 1/10 of what it represents in the place to its left. *Clarifications*: **Examples of Opportunities for In-Depth Focus** The extension of the place value system from whole numbers to decimals is a major intellectual accomplishment involving understanding and skill with base-ten units and fractions. *Content Complexity:* Level 1: Recall
MAFS.5.NBT.1.2	Explain patterns in the number of zeros of the product when multiplying a number by powers of 10, and explain patterns in the placement of the decimal point when a decimal is multiplied or divided by a power of 10. Use whole-number exponents to denote powers of 10. *Content Complexity:* Level 2: Basic Application of Skills & Concepts
MAFS.5.NBT.1.3	Read, write, and compare decimals to thousandths. a. Read and write decimals to thousandths using base-ten numerals, number names, and exp

	Clarifications: **Examples of Opportunities for In-Depth Focus** The extension from one-digit divisors to two-digit divisors requires care. This is a major milestone along the way to reaching fluency with the standard algorithm in grade 6 (6.NS.2). *Content Complexity:* Level 2: Basic Application of Skills & Concepts
MAFS.5.NBT.2.7	Add, subtract, multiply, and divide decimals to hundredths, using concrete models or

represent the problem. *For example, 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. 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 n*

	Content Complexity: Level 1: Recall
MAFS.5.MD.3.4	Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft, and improvised units. *Content Complexity:* Level 1: Recall
MAFS.5.MD.3.5	Relate volume to the operations of multiplication and addition and solve real world and mathematical problems involving volume. a. 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. Represent threefold whole-number products as volumes, e.g., to represent the associative property of multiplication. b. Apply the formulas V = l × w × h and V = B × 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. c. 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. *Clarifications*: **Examples of Opportunities for In-Depth Focus** Students work with volume as an attribute of a solid figure and as a measurement quantity. Students also relate volume to multiplication and addition. This work begins a progression leading to valuable skills in geometric measurement in middle school. *Content Complexity:* Level 2: Basic Application of Skills & Concepts

Domain-Subdomain: GEOMETRY	
Cluster 1: Graph points on the coordinate plane to solve real-world and mathematical problems. (Additional Cluster) Clusters should not be sorted from Major to Supporting and then taught in that order. To do so would strip the coherence of the mathematical ideas and miss the opportunity to enhance the major work of the grade with the supporting clusters.	
STANDARD CODE	**STANDARD**
MAFS.5.G.1.1	Use a pair of perpendicular number lines, called axes, to define a coordinate system, with the intersection of the lines (the origin) arranged to coincide with the 0 on each line and a given point in the plane located by using an ordered pair of numbers, called its coordinates. Understand that the first number indicates how far to travel from the origin in the direction of one axis, and the second number indicates how far to travel in the direction of the second axis, with the convention that the names of the two axes and the coordinates correspond (e.g., x-axis and x-coordinate, y-axis and y-coordinate). *Content Complexity:* Level 1: Recall
MAFS.5.G.1.2	Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the

Cluster 2: Classify two-dimensional figures into categories based on their properties. (Additional Cluster)

Clusters should not be sorted from Major to Supporting and then taught in that order. To do so would strip the coherence of the mathematical ideas and miss the opportunity to enhance the major work of the grade with the supporting clusters.

STANDARD CODE	STANDARD
MAFS.5.G.2.3	Understand that attributes belonging to a category of two-dimensional figures also belong to all subcategories of that category. *For example, all rectangles have four right angles and squares are rectangles, so all squares have four right angles.* *Content Complexity:* Level 2: Basic Application of Skills & Concepts
MAFS.5.G.2.4	Classify and organize two-dimensional figures into Venn diagrams based on the attributes of the figures. *Content Complexity:*

e. Understand the concept of Pi as the ratio of the circumference of a circle to its diameter.

([1]See Table 2 Common Multiplication and Division Situations)

	Clarifications: **Fluency Expectations or Examples of Culminating Standards** Students fluently divide multi-digit numbers using the standard algorithm. This is the culminatin *Content Complexity:* Level 1: Recall
MAFS.6.NS.2.3	Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation. *Clarifications*: **Fluency Expectations or Examples of Culminating Standards** Students fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation. This is the culminating standard for several Operations and Algebraic Thinking, and Number and Operations Fractions. *Content Complexity:* Level 1: Recall

	Content Complexity: Level 2: Basic Application of Skills & Concepts
MAFS.6.NS.3.7	Understand ordering and absolute value of rational numbers.

a. Interpret statements of inequality as statements about the relative position of two numbers on a number line diagram. *For example, interpret -3 > -7 as a statement that -3 is located to the right of -7 on a number line oriented from left to right.*

b.

MAFS.6.EE.1.1	Write and evaluate numerical expressions involving whole-number exponents. *Content Complexity:* Level 1: Recall
MAFS.6.EE.1.2	Write, read, and evaluate expressions in which letters stand for numbers.

a. Write expressions that record operations with numbers and with letters standing for numbers.
as 5 y.

Clusters should not be sorted from Major to Supporting and then taught in that order. To do so would strip the coherence of the mathematical ideas and miss the opportunity to enhance the major work of the grade with the supporting clusters.

STANDARD CODE	STANDARD
MAFS.6.G.1.1	Find the area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques in the context of solving real-world and mathematical problems. *Content Complexity:* Level 2: Basic Application of Skills & Concepts
MAFS.6.G.1.2	Find the volume of a right rectangular prism with fractional edge lengths by packing it with unit cubes of the appropriate unit fraction edge lengths, and show that the volume is the same as would be found by multiplying the edge lengths of the prism. Apply the formulas $V = l\ w\ h$ and $V = B\ h$ to find volumes of right rectangular prisms with fractional edge lengths in the context of solving real-world and mathematical problems. *Content Complexity:* Level 2: Basic Application of Skills & Concepts
MAFS.6.G.1.3	Draw polygons in the coordinate plane given coordinates for the vertices; use coordinates to find the length of a side joining points with the same first coordinate or the same second coordinate. Apply these techniques in the context of solving real-world and mathematical problems. *Content Complexity:* Level 2: Basic Application of Skills & Concepts
MAFS.6.G.1.4	Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures. Apply these techniques in the context of solving real-world and mathematical problems. *Content Complexity:* Level 2: Basic Application of Skills & Concepts

Domain-Subdomain: STATISTICS & PROBABILITY

Cluster 1: Develop understanding of statistical variability. (Additional Cluster)

Clusters should not be sorted from Major to Supporting and then taught in that order. To do so would strip the coherence of the mathematical ideas and miss the opportunity to enhance the major work of the grade with the supporting clusters.

STANDARD CODE	STANDARD
MAFS.6.SP.1.1	

Clusters should not be sorted from Major to Supporting and then taught in that order. To do so would strip the coherence of the mathematical ideas and miss the opportunity to enhance the major work of the grade with the supporting clusters.

STANDARD CODE	STANDARD
MAFS.6.SP.2.4	Display numerical data in plots on a number line, including dot plots, histograms, and box plots. *Content Complexity:* Level 2: Basic Application of Skills & Concepts

	irrational numbers, and will develop further in high school, expanding to become the complex numbers with the introduction of imaginary numbers. Because there are no specific standards for rational number arithmetic in later grades and because so much other work in grade 7 depends on rational number arithmetic, fluency with rational number arithmetic should be the goal in grade 7. *Content Complexity:* Level 2: Basic Application of Skills & Concepts
MAFS.7.NS.1.2	Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers. a. Understand that multiplication is extended from fractions to rational numbers by requiring that operations continue to satisfy the properties of operations, particularly the distributive property, leading to products such as (1)(1) = 1 and the rules for multiplying signed numbers. Interpret products of rational numbers by describing real-world contexts. b. Understand that integers can be divided, provided that the divisor is not zero, and every quotient of integers (with non-zero divisor) is a rational number. If p and q are integers, then (p/q) = (p)/q = p/(q). Interpret quotients of rational numbers by describing real-world contexts. c. Apply properties of operations as strategies to multiply and divide rational numbers. d. Convert a rational number to a decimal using long division; know that the decimal form of a rational number terminates in 0s or eventually repeats. *Clarifications*: **Fluency Expectations or Examples of Culminating Standards** Adding, subtracting, multiplying, and dividing rational numbers is the culmination of numerical work with the four basic operations. The number system will continue to develop in grade 8, expanding to become the real numbers by the introduction of irrational numbers, and will develop further in high school, expanding to become the complex numbers with the introduction of imaginary numbers. Because there are no specific standards for rational number arithmetic in later grades and because so much other work in grade 7 depends on rational number arithmetic, fluency with rational number arithmetic should be the goal in grade 7. *Content Complexity:* Level 2: Basic Application of Skills & Concepts
MAFS.7.NS.1.3	Solve real-world and mathematical problems involving the four operations with rational numbers. *Clarifications*: **Examples of Opportunities for In-Depth Focus** When students work toward meeting this standard (which is closely connected to 7.NS.1.1 and 7.NS.1.2), they consolidate their skill and understanding of addition, subtraction, multiplication and division of rational numbers. *Content Complexity:* Level 2: Basic Application of Skills & Concepts

Domain-Subdomain: EXPRESSIONS & EQUATIONS

Clusters should not be sorted from Major to Supporting and then taught in that order. To do so would strip the coherence of the mathematical ideas and miss the opportunity to enhance the major work of the grade with the supporting clusters.

	inequality and interpret it in the context of the problem. *For example: As a salesperson, you are paid $50 per week plus $3 per sale. This week you want your pay to be at least $100. Write an inequality for the number of sales you need to make, and describe the solutions.* *Clarifications*: **Fluency Expectations or Examples of Culminating Standards** In solving word problems leading to one-variable equations of the form px + q = r and p(x + q) = r, students solve the equations fluently. This will require fluency with rational number arithmetic (7.NS.1.1 1.3), as well as fluency to some extent with applying properties operations to rewrite linear expressions with rational coefficients (7.EE.1.1). **Examples of Opportunities for In-Depth Focus** Work toward meeting this standard builds on the work that led to meeting 6.EE.2.7 and prepares students for the work that will lead to meeting 8.EE.3.7. *Content Complexity:* Level 2: Basic Application of Skills & Concepts

Domain-Subdomain: GEOMETRY

Cluster 1: Draw, construct, and describe geometrical figures and describe the relationships between them. (Additional Cluster)

Clusters should not be sorted from Major to Supporting and then taught in that order. To do so would strip the coherence of the mathematical ideas and miss the opportunity to enhance the major work of the grade with the supporting clusters.

STANDARD CODE	STANDARD
MAFS.7.G.1.1	Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale. *Content Complexity:* Level 2: Basic Application of Skills & Concepts
MAFS.7.G.1.2	Draw (freehand, with ruler and protractor, and with technology) geometric shapes with given conditions. Focus on constructing triangles from three measures of angles or sides, noticing when the conditions determine a unique triangle, more than one triangle, or no triangle. *Content Complexity:* Level 2: Basic Application of Skills & Concepts
MAFS.7.G.1.3	Describe the two-dimensional figures that result from sli(e)9(t)-3(ri)-4(a)964(i)9((e)(n)-3(

MAFS.7.G.2.4	Know the formulas for the area and circumference of a circle and use them to solve problems; give an informal derivation of the relationship between the circumference and area of a circle. *Content Complexity:* Level 2: Basic Application of Skills & Concepts
MAFS.7.G.2.5	Use facts about supplementary, complementary, vertical, and adjacent angles in a multi-step problem to write and solve simple equations for an unknown angle in a figure. *Content Complexity:* Level 2: Basic Application of Skills & Concepts
MAFS.7.G.2.6	Solve real

	basketball team is 10 cm greater than the mean height of players on the soccer team, about twice the variability (mean absolute deviation) on either team; on a dot plot, the separation between the two distributions of heights is noticeable. *Content Complexity:* Level 2: Basic Application of Skills & Concepts
MAFS.7.SP.2.4	Use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations. *For example, decide whether the words in a chapter of a seventh-grade science book are generally longer than the words in a chapter of a fourth-grade science book.* *Content Complexity:* Level 2: Basic Application of Skills & Concepts

Cluster 3: Investigate chance processes and develop, use, and evaluate probability models. (Supporting Cluster)

Clusters should not be sorted from Major to Supporting and then taught in that order. To do so would strip the coherence of the mathematical ideas and miss the opportunity to enhance the major work of the grade with the supporting clusters.

STANDARD CODE	STANDARD
MAFS.7.SP.3.5	Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. Larger numbers indicate greater likelihood. A probability near 0 indicates an unlikely event, a probability around 1/2 indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event. *Content Complexity:* Level 1: Recall
MAFS.7.SP.3.6	Approximate the probability of a chance event by collecting data on the chance process that produces it and observing its long-run relative frequency, and predict the approximate relative frequency given the probability. *For example, when rolling a number cube 600 times, predict that a 3 or 6 would be rolled roughly 200 times, but probably not exactly 200 times.* *Content Complexity:* Level 2: Basic Application of Skills & Concepts
MAFS.7.SP.3.7	Develop a probability model and use it to find probabilities of events. Compare probabilities from a model to observed frequencies; if the agreement is not good, explain possible sources of the discrepancy. a. Develop a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events. *For example, if a student is selected at random from a class, find the probability that Jane will be selected and the probability that a girl will be selected.* b. Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process. *For example, find the approximate probability that a spinning penny will land heads up or that a tossed paper cup will land open-end down. Do the outcomes for the spinning penny appear to be equally likely based on the observed frequencies?* *Content Complexity:* Level 3: Strategic Thinking & Complex Reasoning
MAFS.7.SP.3.8	Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation. a.

	space which compose the event. c. Design and use a simulation to generate frequencies for compound events. *For example, use random digits as a simulation tool to approximate the answer to the question: If 40% of donors have type A blood, what is the probability that it will take at least 4 donors to find one with type A blood?* *Content Complexity:* Level 3: Strategic Thinking & Complex Reasoning

GRADE: 8

Domain-Subdomain: THE NUMBER SYSTEM
Cluster

x = a, a = a, or a = b results (where a and b

onal number coefficients, including equations
ding expressions using the distributive property

	Content Complexity: Level 1: Recall

Cluster 3: Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres. (Additional Cluster) Clusters should not be sorted from Major to Supporting and then taught in that order. To do so would strip the coherence of the mathematical ideas and miss the opportunity to enhance the major work of the grade with the supporting clusters.	
STANDARD CODE	**STANDARD**
MAFS.8.G.3.9	Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems. *Clarifications*:

	graph contains the points (1,1), (2,4) and (3,9), which are not on a straight line. *Content Complexity:* Level 2: Basic Application of Skills & Concepts

Cluster

	Content Complexity: Level 3: Strategic Thinking & Complex Reasoning

GRADE: 912

Domain-Subdomain: NUMBER & QUANTITY: THE REAL NUMBER SYSTEM	
Cluster 1: Extend the properties of exponents to rational exponents. (Algebra 1 - Major Cluster) (Algebra 2 - Major Cluster) Clusters should not be sorted from Major to Supporting and then taught in that order. To do so would strip the coherence of the mathematical ideas and miss the opportunity to enhance the major work of the grade with the supporting clusters.	
STANDARD CODE	**STANDARD**
MAFS.912.N-RN.1.1	Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. *For example, we define to be the cube root of 5 because we want = to hold, so must equal 5.* *Content Complexity:* Level 2: Basic Application of Skills & Concepts
MAFS.912.N-RN.1.2	Rewrite expressions involving radicals and rational exponents using the properties of exponents. *Content Complexity:* Level 1: Recall

Cluster 2: Use properties of rational and irrational numbers. (Algebra 1 - Additional Cluster) Clusters should not be sorted from Major to Supporting and then taught in that order. To do so would strip the coherence of the mathematical ideas and miss the opportunity to enhance the major work of the grade with the supporting clusters.	
STANDARD CODE	**STANDARD**
MAFS.912.N-RN.2.3	Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational. *Content Complexity:*

MAFS.912.N-Q.1.2 Define appropriate quantities for the purpose of descriptive modeling.

Clarifications:

Algebra 1 Content Notes:

direction. Represent vector subtraction graphically by connecting the tips in

Cluster 1: Interpret the structure of expressions. (Algebra 1 - Major Cluster) (Algebra 2 - Major Cluster)

Clusters should not be sorted from Major to Supporting and then taught in that order. To do so would strip the coherence of the mathematical ideas and miss the opportunity to enhance the major work of the grade with the supporting clusters.

STANDARD CODE	STANDARD
MAFS.912.A-SSE.1.1	Interpret expressions that represent a quantity in terms of its context. a. Interpret parts of an expression, such as terms, factors, and coefficients. b. Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example, interpret as the product of P and a factor not depending on P.* *Content Complexity:* Level 2: Basic Application of Skills & Concepts
MAFS.912.A-SSE.1.2	Use the structure of an expression to identify ways to rewrite it. *For example, see $x^4 - y^4$ as $(x^2)^2$ $(y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 - y^2)(x^2 + y^2)$.* *Content Complexity:* Level 2: Basic Application of Skills & Concepts

Cluster 2: Write expressions in equivalent forms to solve problems. (Algebra 1 - Supporting Cluster) (Algebra 2 - Major Cluster)

Clusters should not be sorted from Major to Supporting and then taught in that order. To do so would strip the coherence of the mathematical ideas and miss the opportunity to enhance the major work of the grade with the supporting clusters.

STANDARD CODE	STANDARD
MAFS.912.A-SSE.2.3	Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. a. Factor a quadratic expression to reveal the zeros of the function it defines. b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines. c. Use the properties of exponents to transform expressions for exponential functions. *For example the expression can be rewritten as to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.* *Content Complexity:* Level 2: Basic Application of Skills & Concepts
MAFS.912.A-SSE.2.4	Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems.

Cluster 1: Perform arithmetic operations on polynomials. (Algebra 1 - Major Cluster)

Clusters should not be sorted from Major to Supporting and then taught in that order. To do so would strip the coherence of the mathematical ideas and miss the opportunity to enhance the major work of the grade with the supporting clusters.

STANDARD CODE	STANDARD
MAFS.912.A-APR.1.1	

Cluster 4: Rewrite rational expressions. (Algebra 2 - Supporting Cluster)

Clusters should not be sorted from Major to Supporting and then taught in that order. To do so would strip the coherence of the mathematical ideas and miss the opportunity to enhance the major work of the grade with the supporting clusters.

STANDARD CODE	STANDARD
MAFS.912.A-APR.4.6	Rewrite simple rational expressions in different forms; write a(x)/b(x) in the form q(x) + r(x)/b(x), where a(x), b(x), q(x), and r(x) are polynomials with the degree of r(x) less than the degree of b(x), using inspection, long division, or, for the more complicated examples, a computer algebra system. *Content Complexity:* Level 2: Basic Application of Skills & Concepts
MAFS.912.A-APR.4.7	Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions. *Content Complexity:* Level 2: Basic Application of Skills & Concepts

Domain-Subdomain: ALGEBRA: CREATING EQUATIONS

Cluster 1: Create equations that describe numbers or relationships. (Algebra 1 - Major Cluster) (Algebra 2 - Supporting Cluster)

Clusters should not be sorted from Major to Supporting and then taught in that order. To do so would strip the coherence of the mathematical ideas and miss the opportunity to enhance the major work of the grade with the supporting clusters.

STANDARD CODE	STANDARD
MAFS.912.A-CED.1.1	Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational, absolute, and exponential functions. __ *Content Complexity:* Level 2: Basic Application of Skills & Concepts
MAFS.912.A-CED.1.2	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. __ *Content Complexity:* Level 2: Basic Application of Skills & Concepts
MAFS.912.A-CED.1.3	Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.* __ *Content Complexity:* Level 3: Strategic Thinking & Complex Reasoning
MAFS.912.A-CED.1.4	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. __ *Content Complexity:* Level 1: Recall

Domain-Subdomain: ALGEBRA: REASONING WITH EQUATIONS & INEQUALITIES

Cluster 1: Understand solving equations as a process of reasoning and explain the reasoning. (Algebra 1 - Major Cluster) (Algebra 2 - Major Cluster)

MAFS.912.A-REI.3.6	Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables. *Content Complexity:* Level 1: Recall
MAFS.912.A-REI.3.7	Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. *For example, find the points of intersection between the line y = 3x and the circle $x^2 + y^2 = 3$.* *Content Complexity:* Level 2: Basic Application of Skills & Concepts
MAFS.912.A-REI.3.8	Represent a system of linear equations as a single matrix equation in a vector variable. *Content Complexity:* Level 1: Recall
MAFS.912.A-REI.3.9	Find the inverse of a matrix if it exists and use it to solve systems of linear equations (using technology for matrices of dimension 3 × 3 or greater). *Content Complexity:* Level 2: Basic Application of Skills & Concepts

Cluster 4: Represent and solve equations and inequalities graphically. (Algebra 1 - Major Cluster) (Algebra 2 - Major Cluster)

Clusters should not be sorted from Major to Supporting and then taught in that order. To do so would strip the coherence of the mathematical ideas and miss the opportunity to enhance the major work of the grade with the supporting clusters.

STANDARD CODE	STANDARD
MAFS.912.A-REI.4.10	Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line). *Content Complexity:* Level 1: Recall
MAFS.912.A-REI.4.11	Explain why the x-coordinates of the points where the graphs of the equations y = f(x) and y = g(x) intersect are the solutions of the equation f(x) = g(x); find the solutions approxixixixi39q72.744 295.25 116.16 74.064 reW* nB.727 of utld16(o)9(n)-e(a)-3(7)-3(t

	corresponding to the input x. The graph of f is the graph of the equation y = f(x). *Content Complexity:* Level 1: Recall
MAFS.912.F-IF.1.2	Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context. *Content Complexity:* Level 2: Basic Application of Skills & Concepts
MAFS.912.F-IF.1.3	Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. For example, the Fibonacci sequence is defined recursively by f(0) = f(1) = 1, f(n+1) = f(n) + f(n-1) for n 1. *Content Complexity:* Level 2: Basic Application of Skills & Concepts

Cluster 2: Interpret functions that arise in applications in terms of the context. (Algebra 1 - Major Cluster) (Algebra 2 - Major Cluster)

Clusters should not be sorted from Major to Supporting and then taught in that order. To do so would strip the coherence of the mathematical ideas and miss the opportunity to enhance the major work of the grade with the supporting clusters.

STANDARD CODE	STANDARD
MAFS.912.F-IF.2.4	For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.* __ *Content Complexity:* Level 2: Basic Application of Skills & Concepts
MAFS.912.F-IF.2.5	Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble engines in a factory, then the positive integers would be an appropriate domain for the function.* __ *Content Complexity:* Level 2: Basic Application of Skills & Concepts
MAFS.912.F-IF.2.6	Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. __ *Content Complexity:* Level 2: Basic Application of Skills & Concepts

Cluster 3: Analyze functions using different representations. (Algebra 1 - Supporting Cluster) (Algebra 2 - Supporting Cluster)

Clusters should not be sorted from Major to Supporting and then taught in that order. To do so would strip the coherence of the mathematical ideas and miss the opportunity to enhance the major work of the grade with the supporting clusters.

STANDARD CODE	STANDARD
MAFS.912.F-IF.3.7	Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. __ a. Graph linear and quadratic functions and show intercepts, maxima, and minima. b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.

	d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior. e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude, and using phase shift. *Content Complexity:* Level 2: Basic Application of Skills & Concepts
MAFS.912.F-IF.3.8	Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context. b. Use the properties of exponents to interpret expressions for exponential functions. *For example, identify percent rate of change in functions such as y =* *, y =* *, y =* *, and classify them as representing exponential growth or decay.* *Content Complexity:* Level 2: Basic Application of Skills & Concepts
MAFS.912.F-IF.3.9	Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions)*. For example, given a graph of one D.sm0 Ga657.34 9yC7 D.3(x)-6(t.)] TJF4 of Skd by ane57.34 9yC7m0eW*r*

MAFS.912.F-BF.1.2

	a. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals. b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another. *Content Complexity:* Level 3: Strategic Thinking & Complex Reasoning
MAFS.912.F-LE.1.2	Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table). __ *Content Complexity:* Level 2: Basic Application of Skills & Concepts
MAFS.912.F-LE.1.3	Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function. __ *Content Complexity:* Level 2: Basic Application of Skills & Concepts
MAFS.912.F-LE.1.4	For exponential models, express as a logarithm the solution to = d where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology. __ *Content Complexity:* Level 2: Basic Application of Skills & Concepts

Cluster 2: Interpret expressions for functions in terms of the situation they model. (Algebra 1 - Supporting Cluster) (Algebra 2 - Additional Cluster)

Clusters should not be sorted from Major to Supporting and then taught in that order. To do so would strip the coherence of the mathematical ideas and miss the opportunity to enhance the major work of the grade with the supporting clusters.

STANDARD CODE	STANDARD
MAFS.912.F-LE.2.5	

MAFS.912.F-TF.1.3	Use special triangles to determine geometrically the values of sine, cosine, tangent for x in terms of their values for x, where x is any real number. *Content Complexity:* Level 2: Basic Application of Skills & Concepts
MAFS.912.F-TF.1.4	Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions. *Content Complexity:* Level 2: Basic Application of Skills & Concepts

MAFS.912.G-CO.1.1	Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc. *Content Complexity:* Level 1: Recall
MAFS.912.G-CO.1.2	Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch). *Content Complexity:* Level 2: Basic Application of Skills & Concepts
MAFS.912.G-CO.1.3	Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself. *Content Complexity:* Level 2: Basic Application of Skills & Concepts
MAFS.912.G-CO.1.4	Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments. *Content Complexity:* Level 3: Strategic Thinking & Complex Reasoning
MAFS.912.G-CO.1.5	Given a geometric figure and a rotation, reflect2 Tfo*-3(,)11(re)-5(flp)-3(e)-3(rp)-3(eeS/F

b.

MAFS.912.G-SRT.3.8	Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems. __ *Content Complexity:* Level 2: Basic Application of Skills & Concepts

Cluster 4: Apply trigonometry to general triangles	
STANDARD CODE	**STANDARD**
MAFS.912.G-SRT.4.10	Prove the Laws of Sines and Cosines and use them to solve problems. *Content Complexity:* Level 3: Strategic Thinking & Complex Reasoning
MAFS.912.G-SRT.4.11	Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-

	of proportionality; derive the formula for the area of a sector. *Content Complexity:* Level 3: Strategic Thinking & Complex Reasoning

Domain-Subdomain: GEOMETRY: EXPRESSING GEOMETRIC PROPERTIES WITH EQUATIONS

Cluster 1: Translate between the geometric description and the equation for a conic section. (Geometry - Additional Cluster) (Algebra 2 - Additional Cluster)

Clusters should not be sorted from Major to Supporting and then taught in that order. To do so would strip the coherence of the mathematical ideas and miss the opportunity to enhance the major work of the grade with the supporting clusters.

	Fluency with the use of coordinates to establish geometric results, calculate length and angle, and use geometric representations as a modeling tool are some of the most valuable tools in mathematics and related fields. *Content Complexity:* Level 2: Basic Application of Skills & Concepts
MAFS.912.G-GPE.2.6	Find the point on a directed line segment between two given points that partitions the segment in a given ratio. *Content Complexity:* Level 1: Recall
MAFS.912.G-GPE.2.7	Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula. *Clarifications*: **Geometry - Fluency Recommendations** Fluency with the use of coordinates to establish geometric results, calculate length and angle, and use geometric representations as a modeling tool are some of the most valuable tools in mathematics and related fields. *Content Complexity:* Level 1: Recall

Domain-Subdomain: GEOMETRY: GEOMETRIC MEASUREMENT & DIMENSION

Cluster 1: Explain volume formulas and use them to solve problems. (Geometry - Additional Cluster)

Clusters should not be sorted from Major to Supporting and then taught in that order. To do so would strip the coherence of the mathematical ideas and miss the opportunity to enhance the major work of the grade with the supporting clusters.

Domain-Subdomain: GEOMETRY: MODELING WITH GEOMETRY	
Cluster 1: Apply geometric concepts in modeling situations. (Geometry - Major Cluster) Clusters should not be sorted from Major to Supporting and then taught in that order. To do so would strip the coherence of the mathematical ideas and miss the opportunity to enhance the major work of the grade with the supporting clusters.	
STANDARD CODE	**STANDARD**
MAFS.912.G-MG.1.1	Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder). __ *Content Complexity:* Level 1: Recall
MAFS.912.G-MG.1.2	Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot). __ *Content Complexity:* Level 2: Basic Application of Skills & Concepts
MAFS.912.G-MG.1.3	Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios). __ *Content Complexity:* Level 3: Strategic Thinking & Complex Reasoning

	such as the shape of the distribution or the existence of extreme data points. *Content Complexity:* Level 2: Basic Application of Skills & Concepts
MAFS.912.S-ID.1.4	Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve. *Content Complexity:* Level 2: Basic Application of Skills & Concepts

Cluster 2: Summarize, represent, and interpret data on two categorical and quantitative variables. (Algebra 1 - Supporting Cluster) (Algebra 2 - Supporting Cluster)

Clusters should not be sorted from Major to Supporting and then taught in that order. To do so would strip the coherence of the mathematical ideas and miss the opportunity to enhance the major work of the grade with the supporting clusters.

STANDARD CODE	STANDARD
MAFS.912.S-ID.2.5	

Clusters should not be sorted from Major to Supporting and then taught in that order. To do so would strip the coherence of the mathematical ideas and miss the opportunity to enhance the major work of the grade with the supporting clusters.

STANDARD CODE	STANDARD
MAFS.912.S-CP.1.1	Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or *Content Complexity:* Level 1: Recall
MAFS.912.S-CP.1.2	Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent. *Content Complexity:* Level 1: Recall
MAFS.912.S-CP.1.3	Understand the conditional probability of A given B as P(A and B)/P(B), and interpret independence of A and B as saying that the conditional probability of A given B is the same as the probability of A, and the conditional probability of B given A is the same as the probability of B. *Content Complexity:* Level 2: Basic Application of Skills & Concepts
MAFS.912.S-CP.1.4	Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. *For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results.* *Content Complexity:* Level 2: Basic Application of Skills & Concepts
MAFS.912.S-CP.1.5	Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. *For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.* *Content Complexity:* Level 2: Basic Application of Skills & Concepts

Cluster 2: Use the rules of probability to compute probabilities of compound events in a uniform probability model. (Algebra 2 - Additional Cluster)

Clusters should not be sorted from Major to Supporting and then taught in that order. To do so would strip the coherence of the mathematical ideas and miss the opportunity to enhance the major work of the grade with the supporting clusters.

STANDARD CODE	STANDARD
MAFS.912.S-CP.2.6	belong to A, and interpret the answer in terms of the model. *Content Complexity:* Level 2: Basic Application of Skills & Concepts
MAFS.912.S-CP.2.7	Apply the Addition Rule, P(A or B) = P(A) + P(B) P(A and B), and interpret the answer in terms of the model. *Content Complexity:* Level 2: Basic Application of Skills & Concepts
MAFS.912.S-CP.2.8	Apply the general Multiplication Rule in a uniform probability model, P(A and B) = P(A)P(B|A) = P(B)P(A|B), and interpret the answer in terms of the model. *Content Complexity:* Level 2: Basic Application of Skills & Concepts

MAFS.912.S-CP.2.9	Use permutations and combinations to compute probabilities of compound events and solve problems. *Content Complexity:* Level 2: Basic Application of Skills & Concepts

Domain-Subdomain: STATISTICS & PROBABILITY: USING PROBABILITY TO MAKE DECISIONS

Cluster 1:

	Content Complexity: Level 2: Basic Application of Skills & Concepts
MAFS.912.S-MD.2.7	Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game). *Content Complexity:* Level 3: Strategic Thinking & Complex Reasoning

Domain-Subdomain: CALCULUS

MAFS.912.C.1.10	Decide if a function is continuous at a point. *Clarifications*: Example: Determine if the function ? can be made continuous by defining the function with a specific value at x=2. *Content Complexity:* Level 3: Strategic Thinking & Complex Reasoning

MAFS.912.C.1.11

	Content Complexity: Level 1: Recall
MAFS.912.C.1.4	Find limits of rational functions that are undefined at a point. *Clarifications*: Example 1: Find? Example 2: The magnitude of the force between two positive charges, q1 and q2 can be described by the following function: , where *k* is a constant, called Coulomb's constant, and *r* is the distance between the two charges. Find . Interpret the?answer in the context of the force between the two charges. *Content Complexity:* Level 1: Recall
MAFS.912.C.1.5	Find one-sided limits. *Clarifications*: Example 1: Find ? Example 2: Find ? *Content Complexity:* Level 1: Recall
MAFS.912.C.1.6	Find limits at infinity. *Clarifications*: Example 1: Find Example 2: Find Example 3: Find? *Content Complexity:* Level 2: Basic Application of Skills & Concepts
MAFS.912.C.1.7	Decide when a limit is infinite and use limits involving infinity to describe asymptotic behavior.

	Example 1: Find? Example 2: Where does the following function have asymptote(s)? Explain your answer. *Content Complexity:* Level 2: Basic Application of Skills & Concepts

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MAFS.912.C.2.10	Understand and use the relationship between differentiability and continuity. *Clarifications*: Example 1: Let f(x)=1/x. Is f(x) continuous at x = 0? Is f(x) differentiable at x = 0? Explain your answers. Example 2: Is f(x) = IxI continuous at x=0? Is f(x) differentiable at x=0? Explain your answers. *Content Complexity:* Level 2: Basic Application of Skills & Concepts

MAFS.912.C.2.11

	Example 3: The graph of the function f(x) is given below. Find a function g(x) such that the derivative of g(x) will be f(x). Explain your solution. *Content Complexity:* Level 2: Basic Application of Skills & Concepts

MAFS.912.C.2.3

	at 15 mph.? Both boats are heading toward the same point. If the boats maintain their speeds and directions, they will meet in two hours. Find the rate (in miles per hour) that the distance between them is decreasing exactly one hour before they meet. *Content Complexity:* Level 3: Strategic Thinking & Complex Reasoning
MAFS.912.C.3.12	Solve problems using the Newton-Raphson method. *Clarifications*: Example 1: Use three iterations of Newton?s method to approximate the zero(s) of $f(x) = x$? cos$x$. Example 2: Approximate the zero(s) of the function f(x) = 1 ? $2x^3$ using Newton?s Method.? Continue until two successive approximations differ by less than 0.001.?? *Content Complexity:* Level 3: Strategic Thinking & Complex Reasoning
MAFS.912.C.3.2	Find an equation for the tangent line to a curve at a point and a local linear approximation. *Clarifications*: Example 1: Find an equation of the line tangent to the graph of the equation at the point (2, 8). Example 2: Use a local linear approximation to estimate the derivative of? at x=2. *Content Complexity:* Level 2: Basic Application of Skills & Concepts
MAFS.912.C.3.3	Decide where functions are decreasing and increasing. Understand the relationship between the increasing and decreasing behavior of f and the sign of f'. *Clarifications*: Example 1:?For what values of x, is the function?? decreasing? Example 2: The weight of a new infant baby during the first two months can be modeled by the following function: ? , w represents weight in pounds, and t represents time in months. When is the infant gaining weight or losing

	Clarifications: Example: For the graph of the function , find the points of inflection of f(x) and determine where f(x) is concave upward and concave downward. *Content Complexity:* Level 2: Basic Application of Skills & Concepts
MAFS.912.C.3.6	Use first and second derivatives to help sketch graphs. Compare the corresponding characteristics of the graphs of f, f', and f''. *Clarifications*: Example: Use information from the first and second derivatives to sketch the graph of . *Content Complexity:* Level 3: Strategic Thinking & Complex Reasoning
MAFS.912.C.3.7	Use implicit differentiation to find the derivative of an inverse function. *Clarifications*: Example: Let and find g'(x) using implicit differentiation. *Content Complexity:* Level 2: Basic Application of Skills & Concepts
MAFS.912.C.3.8	Solve optimization problems. *Clarifications*: Example 1: You want to enclose a rectangular field with an area of . Find the shortest length of fencing you can use. Example 2: The sum of the perimeters of an equilateral triangle and a square is 20. Find the dimensions of each that will produce the least area. *Content Complexity:* Level 2: Basic Application of Skills & Concepts
MAFS.912.C.3.9	Find average and instantaneous rates of change. Understand the instantaneous rate of change as the limit of the average rate of change. Interpret a derivative as a rate of change in applications, including velocity, speed, and acceleration. *Clarifications*: Example:?The vertical distance traveled by an object within the earth?s gravitational field (and neglecting air resistance) is given by the equation? , where g is the force on the object due to earth?s gravity, V_o is the initial velocity, X_o is the initial height above the ground, t is the time in seconds, and down is the negative vertical direction.? Determine the instantaneous speed and the average speed for an object, initially at rest, 3 seconds after it is dropped from a 100m tall cliff.? What about 5 seconds after?. Use . *Content Complexity:* Level 2: Basic Application of Skills & Concepts

differentiation ? the Fundamental Theorem of Calculus. Use this result to find definite and indefinite integrals, including using the method of integration by substitution. Apply approximate methods, such as the Trapezoidal Rule, to find definite integrals. Define integrals using Riemann sums, use the Fundamental Theorem of Calculus to find integrals using antiderivatives, and use basic properties of integrals. Integrate by substitution, and find approximate integrals.	
STANDARD CODE	**STANDARD**
MAFS.912.C.4.1	Use rectangle approximations to find approximate values of integrals. *Clarifications*: Example: Find an approximate value for using 6 rectangles of equal width under? the graph of between x=0 and x=3. How did you form your rectangles? Compute this approximation three times using at least three different methods to form the rectangles. *Content Complexity:* Level 1: Recall
MAFS.912.C.4.2	Calculate the values of Riemann Sums over equal subdivisions using left, right, and midpoint evaluation points. *Clarifications*: Example 1: Find the value of the Riemann Sum over the interval [0, 1] using 6 subintervals of equal width for? evaluated at the midpoint of each subinterval. Example 2: Estimate?? using a Riemann midpoint sum with 4 subintervals. *Content Complexity:* Level 1: Recall
MAFS.912.C.4.3	Interpret a definite integral as a limit of Riemann sums. *Clarifications*: Example: Find the values of the Riemann sums over the interval???? ?[0, 1] using 12 and?24 subintervals of equal width for? evaluated at the midpoint of each subinterval. Write an expression for the Riemann sums using n intervals of equal width. Find the limit of this Riemann Sums as n goes to infinity. *Content Complexity:* Level 2: Basic Application of Skills & Concepts
MAFS.912.C.4.4	Interpret a definite integral of the rate of change of a quantity over an interval as the change of the quantity over the interval. That is,? $f'(x)dx$

MAFS.912.C.4.5 Use the Fundamental Theorem of Calculus to evaluate definite and indefinite integrals and to represent particular antiderivatives. Perform analytical and graphical analysis of functions so defined.

Clarifications:

	Content Complexity: Level 1: Recall
MAFS.912.C.4.7	Use integration by substitution (or change of variable) to find values of integrals. *Clarifications*: Example: Find *Content Complexity:* Level 2: Basic Application of Skills & Concepts
MAFS.912.C.4.8	Use Riemann Sums, the Trapezoidal Rule, and technology to approximate definite integrals of functions represented algebraically, geometrically, and by tables of values. *Clarifications*: Example 1: Use the Trapezoidal Rule with 6 subintervals over [0, 3] for to approximate the value of . Example 2: Find an approximation to *Content Complexity:* Level 2: Basic Application of Skills & Concepts

Cluster 5: Applications of Integration

Apply knowledge about integrals to finding velocities from accelerations, solving separable differential equations, and finding areas and volumes. Apply integration to model, and solve problems in physics, biology, economics, etc. Find velocity functions and position functions from their derivatives, solve separable differential equations, and use definite integrals to find areas and volumes.

	Content Complexity: Level 2: Basic Application of Skills & Concepts
MAFS.912.C.5.2	Solve separable differential equations, and use them in modeling. *Clarifications*: Example 1: Solve and find a general solution to the following differential equation: . Example 2: A certain amount of money, P, is earning interest continually at a rate of r. Write a separable differential equation to model the rate of change of the amount of money with respect to time. *Content Complexity:* Level 2: Basic Application of Skills & Concepts
MAFS.912.C.5.3	Solve differential equations of the form as applied to growth and decay problems. *Clarifications*: Example: The amount of a certain radioactive material was 10 kg a year ago. The amount is now 9 kg. When will it be reduced to 1 kg? Explain your answer. *Content Complexity:* Level 2: Basic Application of Skills & Concepts
MAFS.912.C.5.4	Use slope fields to display a graphic representation of the solution to a differential equation, and locate particular solutions to the equation. *Clarifications*: Example: Draw a slope field for and graph the particular solution that passes through the point (2,4). *Content Complexity:* Level 2: Basic Application of Skills & Concepts
MAFS.912.C.5.5	

	Content Complexity: Level 1: Recall
MAFS.912.C.5.7	Use definite integrals to find the volume of a solid with known cross-sectional area, including solids of revolution. *Clarifications*: Example 1: A cone with its vertex at the origin lies symmetrically along the x-axis. The base of the cone is at x = 5 and the base radius is 7. Use integration to find the volume of the cone. Example 2: What is the volume of the solid created when the area between the curves $f(x) = x$ and $g(x) = x^2$? for?*0 x 1* is revolved around the y-axis? *Content Complexity:* Level 3: Strategic Thinking & Complex Reasoning
MAFS.912.C.5.8	Apply integration to model, and solve problems in physical, biological, and social sciences. *Clarifications*: Example: During an acceleration trial, a test vehicle traveling in a straight line has a velocity given by the equation v(t)=sin t , where t is in seconds and velocity is in feet per

Cluster 2: Reason abstractly and quantitatively.	
STANDARD CODE	**STANDARD**
MAFS.K12.MP.2.1	**Reason abstractly and quantitatively**. Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects. *Content Complexity:* Level 3: Strategic Thinking & Complex Reasoning

Cluster 3: Construct viable arguments and critique the reasoning of others.	
STANDARD CODE	**STANDARD**
MAFS.K12.MP.3.1	**Construct viable arguments and critique the reasoning of others.** Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and if there is a flaw in an argument explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or iaor o0(e)-162 497.59 Tm0 G[(Con)-5W* nd6-3(n)-3(d)9(;)11(c)-8(o)-3(n)Tf1 0

	student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose. *Content Complexity:* Level 3: Strategic Thinking & Complex Reasoning

Cluster 5: Use appropriate tools strategically.	
STANDARD CODE	**STANDARD**
MAFS.K12.MP.5.1	**Use appropriate tools strategically.** Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a

	Content Complexity: Level 3: Strategic Thinking & Complex Reasoning

Cluster 7: Look for and make use of structure.	
STANDARD CODE	**STANDARD**
MAFS.K12.MP.7.1	**Look for and make use of structure.** Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see 7 × 8 equals the well remembered 7 × 5 + 7 × 3, in preparation for learning about the distributive property. In the expression x^2 + 9x + 14, older students can see the 14 as 2 × 7 and the 9 as 2 + 7. They recognize the