Common Core State Standards (CCSS) for Mathematics
2007 Mississippi Mathematics Framework Revised (MMFR)
Alignment Analysis

Mississippi Department of Education
Tested Grades and Transitions to Algebra

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Table of Contents

Introduction

Purpose of the Work:

The purpose of the alignment analysis of the *2007 Mississippi Mathematics Framework Revised* (MMFR) with the June 2010, Common Core State Standards (CCSS) for Mathematics is to provide guidance to the Mississippi Department of Education (MDE) in the possible implementation of the CCSS for 2011–2012. The analysis will assist MDE in identifying the objectives in the MMFR that will remain or be modified. MDE will conduct a stakeholders meeting in Fall 2010, to obtain input regarding modifications to the existing Mississippi objectives.

Caveats:

To perform this task, the staff of the Southeast Comprehensive Center (SECC) recognized the following situations:

- There are many inherent concepts and skills that are not stated explicitly that students need to have to fulfill the objectives of the MMFR
- Technical terms may have different names but still may have the same meaning.

To this end, SECC staff included the MMFR objective that best matched the CCSS, even though the alignment was not necessarily a perfect match due to terminology, inclusion, and/or focus.

The notations used in this alignment analysis are taken from both of the documents used, the CCSS for mathematics and the 2007 MMFR. Some of the footnotes referenced in the alignment analysis indicate the use of the CCSR glossary and tables that are not included here but are found at the indicated uniform resource locators (URLs), cited in the references.

Reading the CCSS for Mathematics:

Each CCSS for mathematics denotes what students should know and be able to do and are found by grade level.

Within each grade level, standards are found in large groups called domains. For example, 6-SP denotes the grade level six and the domain Statistics and Probability. Grade 6 has five domains.

Within each domain are clusters of related standards. The domain of Statistics and Probability in grade six has two clusters, develop understanding of statistical variability and summarize and describe distributions.

Reading the *2007 Mississippi Mathematics Framework Revised*

The MMFR is organized by grade level (K–8) and by secondary courses (grades 9–12). The five process standards (problem solving, communication, reasoning and proof, connections, and representation) should permeate all instructional practices.

The framework is comprised of five content strands Number and Operations, Algebra, Geometry, Measurement, and Data Analysis and Probability.

Beneath each content strand are competencies. The competencies are presented in outline form for consistency and for easy reference throughout the framework. Competencies are intentionally broad in order to allow school districts and teachers the flexibility to create a curriculum that meets the needs of their students.

Beneath each competency are objectives. The objectives indicate how competencies can be fulfilled through a progression of content and concepts at each grade level and course. Many of the objectives are interrelated rather than sequential, which means that objectives are not necessarily taught in the specific order in which they are presented. Multiple objectives can and should be taught at the same time.

For matching purposes, the alignment analysis will be done at the CCSS standard level to the MMFR objective level only.

The Format of the Mathematics Alignment Analysis

This alignment analysis includes the grade levels that are tested in the state of Mississippi, 3rd through 8th grade and Algebra I. For each grade level, SECC staff started with a key describing the numeration systems used by the CCSS and MMFR and then used a three-column table, with the first column containing the CCSS for that grade level, the second column containing the matching MMFR objective, if any for that grade level, and the third column containing comments about observations and other information. The last section in the table includes the MMFR objectives that did not match with any CCSS at that grade level.

References

Mississippi State Department of Education. (2007). *Mississippi mathematics framework revised.* Jackson, MS: Author. Retrieved from http://www.mde.k12.ms.us/acad/id/curriculum/Math/index.htm

National Governors Association Center for Best Practices and Council of Chief State School Officers. (2010, June 2). *K–12 common core state standards for mathematics.* Washington, DC: Author. Retrieved from http://corestandards.org/the-standards/mathematics

TESTED GRADES

COMMON CORE STATE STANDARDS (CCSS) FOR MATHEMATICS
2007 MISSISSIPPI MATHEMATICS FRAMEWORK REVISED (MMFR)
ALIGNMENT ANALYSIS
Grade 3

CCSS Key:
Operations and Algebraic Thinking (OA)
Number and Operations in Base Ten (NBT)
Numbers and Operations–Fractions (NF)
Measurement and Data (MD)
Geometry (G)

MMFR Content Standards Key:
Numbers and Operations (1)
Algebra (2)
Geometry (3)
Measurement (4)
Data Analysis and Probability (5)
Depth of Knowledge (DOK)

Common Core State Standards for Mathematics	*2007 MS Mathematics Framework Revised*	Comments
3.OA.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.*	3.1.f. Model multiplication using arrays, equal-sized groups, area models, and equal-sized moves on the number line. (DOK 2)	Interpreting products and modeling multiplication are not synonymous. However, in modeling multiplication, a student might demonstrate a total number of objects in *n* groups of *n* objects each.
3.OA.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*.	3.1.g. Model division with successive or repeated subtraction, partitioning, and sharing. (DOK 2)	Both the CCSS and the MMFR represent whole number quotients by partitioning.
3.OA.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.[1]	3.1.f. Model multiplication using arrays, equal-sized groups, area models, and equal-sized moves on the number line. (DOK 2) 3.1.g. Model division with successive or repeated subtraction, partitioning, and sharing. (DOK 2)	The MMFR does not specify that students use multiplication and division to solve word problems.

[1]See Glossary, Table 2.

Common Core State Standards for Mathematics	*2007 MS Mathematics Framework Revised*	Comments
3.OA.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 = ?.*		The MMFR does not specify that students determine the unknown whole number in a multiplication or division equation until grade 4.2.b.
3.OA.5. Apply properties of operations as strategies to multiply and divide.[2] *Examples: If 6 × 4 = 24 is known, then 4 × 6 = 24 is also known. (Commutative property of multiplication.) 3 × 5 × 2 can be found by 3 × 5 = 15, then 15 × 2 = 30, or by 5 × 2 = 10, then 3 × 10 = 30. (Associative property of multiplication.) Knowing that 8 × 5 = 40 and 8 × 2 = 16, one can find 8 × 7 as 8 × (5 + 2) = (8 × 5) + (8 × 2) = 40 + 16 = 56. (Distributive property.)*	3.2.c. Use real number properties to develop multiple algorithms and to solve problems. (DOK 2) - Associative property of addition - Commutative property of addition - Identity property of addition	The MMFR does not introduce the distributive property until grade 4.2.d.
3.OA.6. Understand division as an unknown-factor problem. *For example, find 32 ÷ 8 by finding the number that makes 32 when multiplied by 8.*	3.1.g. Model division with successive or repeated subtraction, partitioning, and sharing. (DOK 2)	The MMFR does not introduce factors and multiples until grade 4.1.l.
3.OA.7. Fluently multiply and divide within 100, using strategies such as the relationship between multiplication and division (e.g., knowing that 8 × 5 = 40, one knows 40 ÷ 5 = 8) or properties of operations. By the end of grade 3, know from memory all products of two one-digit numbers.	3.1.f. Model multiplication using arrays, equal-sized groups, area models, and equal-sized moves on the number line. (DOK 2) 3.1.g. Model division with successive or repeated subtraction, partitioning, and sharing. (DOK 2)	The MMFR does not specify that students know from memory all products of two one-digit numbers by the end of grade 3; however grade 4.1.i., "recall multiplication and division facts," insinuates that students will be fluent by grade 4.

[2] Students need not use formal terms for these properties.

Common Core State Standards for Mathematics	*2007 MS Mathematics Framework Revised*	Comments
3.OA.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.[3]	3.2.b. Determine the value of missing quantities or variables within equations or number sentences, and justify the process used. (DOK 2)	Grade 3.2.b objective does not specify that students solve two-step word problems. The MMFR does not specify Order of Operations until grade 7.1.a. (see footnote [3]).
3.OA.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.*	3.2.a. Create, describe, and extend growing and repeating patterns with physical materials and symbols including numbers. (DOK 2) 3.1.a. Compose and decompose four-digit whole numbers with representations in words, physical models, and expanded and standard forms. (DOK 1)	The MMFR does not specify that students explain patterns using properties of operations.
3.NBT.1. Use place value understanding to round whole numbers to the nearest 10 or 100.[4]	3.1.c. Estimate sums and differences of whole numbers to include strategies such as rounding. (DOK 2)	Inherent in being able to round numbers is the use of place value understanding.
3.NBT.2. Fluently add and subtract within 1,000 using strategies and algorithms based on place value, properties of operations, and/or the relationship between addition and subtraction.[4]	3.1.e. Add (up to three addends) and subtract four-digit whole numbers with and without regrouping. (DOK 1) 3.2.d. Model and identify the inverse relationships of addition/subtraction. (DOK 2)	
3.NBT.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.[4]	3.1.f. Model multiplication using arrays, equal-sized groups, area models, and equal-sized moves on the number line. (DOK 2)	The MMFR does not specify that students multiply by multiples of 10.

[3]This standard is limited to problems posed with whole numbers and having whole-number answers; students should know how to perform operations in the conventional order when there are no parentheses to specify a particular order (Order of Operations).
[4]A range of algorithms may be used.

Common Core State Standards for Mathematics	*2007 MS Mathematics Framework Revised*	Comments
3.NF.1. Understand a fraction 1/*b* as the quantity formed by 1 part when a whole is partitioned into *b* equal parts; understand a fraction *a/b* as the quantity formed by *a* parts of size 1/*b*.[5]	3.1.d. Identify and model representations of fractions (halves, thirds, fourths, fifths, sixths, and eighths). (DOK 1)	The MMFR does not specify that students understand a fraction as a whole partitioned. However, in modeling representations of fractions, students are portioning the whole into parts.
3.NF.2. Understand a fraction as a number on the number line; represent fractions on a number line diagram.[5] a. Represent a fraction 1/*b* on a number line diagram by defining the interval from 0 to 1 as the whole and partitioning it into *b* equal parts. Recognize that each part has size 1/*b* and that the endpoint of the part based at 0 locates the number 1/*b* on the number line. b. Represent a fraction *a/b* on a number line diagram by marking off *a* lengths 1/*b* from 0. Recognize that the resulting interval has size *a/b* and that its endpoint locates the number *a/b* on the number line.		The MMFR does not specify representing fractions on the number line. Representing a fraction by defining the interval from 0 to 1 or the use of benchmark numbers does not appear in the MMFR until grade 5.1.k.
3.NF.3. Explain equivalence of fractions in special cases, and compare fractions by reasoning about their size.[5] a. Understand two fractions as equivalent (equal) if they are the same size, or the same point on a number line. b. Recognize and generate simple equivalent fractions, *e.g., 1/2 = 2/4, 4/6 = 2/3).* Explain why the fractions are equivalent, e.g., by using a visual fraction model. c. Express whole numbers as fractions, and recognize fractions that are equivalent to whole numbers. *Examples: Express 3 in the form 3 = 3/1; recognize that 6/1 = 6; locate 4/4 and 1 at the same point of a number line diagram.* d. Compare two fractions with the same numerator or the same denominator by reasoning about their		The MMFR does not specify that students understand or explain fraction equivalence until grade 5.1.e. The framework does not compare like and unlike fractions until grade 5.1.a.

Common Core State Standards for Mathematics	*2007 MS Mathematics Framework Revised*	Comments
size. Recognize that comparisons are valid only when the two fractions refer to the same whole. Record the results of comparisons with the symbols >, =, or <, and justify the conclusions, e.g., by using a visual fraction model.		
3.MD.1. Tell and write time to the nearest minute, and measure time intervals in minutes. Solve word problems involving addition and subtraction of time intervals in minutes, e.g., by representing the problem on a number line diagram.		The MMFR specifies that students tell time to the hour, half-hour, quarter-hour, and five-minute interval at grade 2.4.b. The framework does not specify that students solve word problems involving the addition and subtraction of time intervals by representing the problem on a number line.
3.MD.2. Measure and estimate liquid volumes and masses of objects using standard units of grams (g), kilograms (kg), and liters (l).[6] Add, subtract, multiply, or divide to solve one-step word problems involving masses or volumes that are given in the same units, e.g., by using drawings (such as a beaker with a measurement scale) to represent the problem.[7]	3.4.c. Measure capacity, weight/mass, and length in both English and metric systems of measurement. (DOK 1)	The MMFR does not specify that students solve word problems using the four operations involving masses or volumes.
3.MD.3. Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories. Solve one- and two-step “how many more” and “how many less” problems using information presented in scaled bar graphs. *For example, draw a bar graph in which each square in the bar graph might represent 5 pets.*	3.5.a Compare data and interpret quantities represented on tables and different types of graphs (line plots, pictographs, and bar graphs), make predictions, and solve problems based on the information. (DOK 3)	

[5] Grade 3 expectations in this domain are limited to fractions with denominators 2, 3, 4, 6, and 8.
[6] Excludes compound units such as cm3 and finding geometric volume of a container.
[7] Excludes multiplicative comparison problems (problems involving notions of “times as much,” see Glossary, Table 2).

Common Core State Standards for Mathematics	*2007 MS Mathematics Framework Revised*	Comments
3.MD.4. Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by making a line plot, where the horizontal scale is marked off in appropriate units—whole numbers, halves, or quarters.	3.4.b. Estimate and measure length using fractional parts to the nearest ½ inch in the English system. (DOK 2) 3.5.a Compare data and interpret quantities represented on tables and different types of graphs (line plots, pictographs, and bar graphs), make predictions, and solve problems based on the information. (DOK 3)	The MMFR does not specify that students measure to the nearest 1/4 of an inch until grade 4.4.a. By grade 4, the framework specifies that students measure to the nearest 1/8 of an inch.
3.MD.5. Recognize area as an attribute of plane figures, and understand concepts of area measurement. a. A square with side length 1 unit, called “a unit square,” is said to have “one square unit” of area, and can be used to measure area. b. A plane figure which can be covered without gaps or overlaps by *n* unit squares is said to have an area of *n* square units.		The MMFR does not specify that students solve area problems until grade 4.4.c and further at grade 5.4.c.
3.MD.6. Measure areas by counting unit squares (square cm, square m, square in, square ft, and improvised units).		The MMFR does not specify that students solve area problems until grade 4.4.c and further at grade 5.4.c.
3.MD.7. Relate area to the operations of multiplication and addition. a. Find the area of a rectangle with whole-number side lengths by tiling it, and show that the area is the same as would be found by multiplying the side lengths. b. Multiply side lengths to find areas of rectangles with whole-number side lengths in the context of		The MMFR does not specify that students solve area problems until grade 4.4.c. and further at grade 5.4.c.

Common Core State Standards for Mathematics	***2007 MS Mathematics Framework Revised***	**Comments**
solving real-world and mathematical problems, and represent whole-number products as rectangular areas in mathematical reasoning. c. Use tiling to show in a concrete case that the area of a rectangle with whole-number side lengths *a* and *b* + *c* is the sum of *a* × *b* and *a* × *c.* Use area models to represent the distributive property in mathematical reasoning. d. Recognize area as additive. Find areas of rectilinear figures by decomposing them into non-overlapping rectangles and adding the areas of the non-overlapping parts, applying this technique to solve real-world problems.		
3.MD.8. Solve real-world and mathematical problems involving perimeters of polygons, including finding the perimeter given the side lengths, finding an unknown side length, and exhibiting rectangles with the same perimeter and different areas or with the same area and different perimeters.	3.4.a. Develop and use methods to find perimeter of polygons and to solve problems involving perimeter. (DOK 2)	The MMFR deepens the understanding of perimeter problems at grade 4.4.c.
3.G.1. Understand that shapes in different categories (e.g., rhombuses, rectangles, and others) may share attributes (e.g., having four sides), and that the shared attributes can define a larger category (e.g., quadrilaterals). Recognize rhombuses, rectangles, and squares as examples of quadrilaterals, and draw examples of quadrilaterals that do not belong to any of these subcategories.	3.3.a. Describe, compare, analyze, and classify two-dimensional shapes by sides and angles. (DOK 1)	The MMFR does not specify that students compare and contrast different quadrilaterals until grade 5.3.a.
3.G.2. Partition shapes into parts with equal areas. Express the area of each part as a unit fraction of the whole. *For example, partition a shape into 4 parts with equal area, and describe the area of each part as 1/4 of the area of the shape.*	3.3.b. Explain and describe the process of decomposing, composing, and transforming polygons. (DOK 2)	The MMFR does not specify that students express partitioned areas as unit fractions of the whole.
	3.1.b.	The CCSS begins comparing and

Common Core State Standards for Mathematics	*2007 MS Mathematics Framework Revised*	Comments
	Compare and order four-digit numbers using <, >, and =, and justify reasoning. (DOK 2)	ordering three-digit numbers using <, >, and = in 2nd grade.
	3.2.e. Create models for the concept of equality, recognizing that the equal sign (=) denotes equivalent terms such that 4+3=7, 4+3=6+1 or 7=5+2. (DOK 1)	The CCSS addresses understanding the meaning of the equal sign in 1st grade.
	3.3.c. Create three-dimensional shapes (prisms and pyramids) from two-dimensional nets, and create two-dimensional nets from prisms and pyramids. (DOK 2)	While not directly working with nets, the CCSS begins the composing of two- and three-dimensional shapes in 1st grade.
	3.5.b. Analyze, predict, and model the number of different combinations of two or more objects, and relate to multiplication. (DOK 2)	Working with equal groups to gain foundations for multiplication is found at the 2nd grade of the CCSS.

COMMON CORE STATE STANDARDS (CCSS) FOR MATHEMATICS
2007 MISSISSIPPI MATHEMATICS FRAMEWORK REVISED (MMFR)
ALIGNMENT ANALYSIS
Grade 4

CCSS Key:
Operations and Algebraic Thinking (OA)
Number and Operations in Base Ten (NBT)
Number and Operations–Fractions (NF)
Measurement and Data (MD)
Geometry (G)

MMFR Content Standards Key:
Numbers and Operations (1)
Algebra (2)
Geometry (3)
Measurement (4)
Data Analysis and Probability (5)
Depth of Knowledge (DOK)

Common Core State Standards for Mathematics	***2007 MS Mathematics Framework Revised***	**Comments**
4.OA.1. Interpret a multiplication equation as a comparison, e.g., interpret 35 = 5 × 7 as a statement that 35 is 5 times as many as 7 and 7 times as many as 5. Represent verbal statements of multiplicative comparisons as multiplication equations.	4.1.c. Explain two or more methods of multiplying whole numbers (one- and two-digits) with justification. (DOK 2)	Interpret and explain are not synonymous; however, a student might show evidence of interpreting a multiplication equation in explaining how to multiply with justification.
4.OA.2. Multiply or divide to solve word problems involving multiplicative comparison, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem, distinguishing multiplicative comparison from additive comparison.[1]	4.1.c. Explain two or more methods of multiplying whole numbers (one- and two-digits) with justification. (DOK 2) 4.1.d. Explain two or more methods of dividing four-digit dividends by one- and two-digit divisors, with and without remainders, and justify the processes. (DOK 2) 4.2.b. Determine the value of variables in equations; justify the process used to make the determination. (DOK 2)	Solving word problems mentioned in the CCSS are not included in the MMFR. The framework does not specify that students use drawings to distinguish multiplicative comparison from additive comparison.

[1]See Glossary, Table 2.

Common Core State Standards for Mathematics	*2007 MS Mathematics Framework Revised*	Comments
4.OA.3. Solve multistep word problems posed with whole numbers and having whole-number answers using the four operations, including problems in which remainders must be interpreted. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding.	4.1.a. Add and subtract up to five-digit whole numbers with and without regrouping. (DOK 1) 4.1.c. Explain two or more methods of multiplying whole numbers (one- and two-digits) with justification. (DOK 2) 4.1.d. Explain two or more methods of dividing four-digit dividends by one- and two-digit divisors, with and without remainders, and justify the processes. (DOK 2) 4.2.b. Determine the value of variables in equations; justify the process used to make the determination. (DOK 2)	Solving word problems, as mentioned in the CCSS, is not included in the MMFR. The framework does not specify that students assess the reasonableness of answers using estimation and rounding until grade 6.1.b.
4.OA.4. Find all factor pairs for a whole number in the range 1–100. Recognize that a whole number is a multiple of each of its factors. Determine whether a given whole number in the range 1–100 is a multiple of a given one-digit number. Determine whether a given whole number in the range 1–100 is prime or composite.	4.1.l. Model factors and multiples of whole numbers. (DOK 1)	The MMFR does not specify the whole number range of 1–100 or whether a given whole number is a multiple of a one-digit number. Determining whether a given whole number is prime or composite is not in the framework until grade 5.1.d.
4.OA.5. Generate a number or shape pattern that follows a given rule. Identify apparent features of the pattern that were not explicit in the rule itself. *For example, given the rule "Add 3" and the starting number 1, generate terms in the resulting sequence and observe that the terms appear to alternate between odd and even numbers. Explain informally why the numbers will continue to alternate in this way*.	4.2.a. Analyze a given numeric pattern and generate a similar pattern. (DOK 2)	The MMFR does not specify that students explain why numbers in the suggested pattern will alternate between even and odd.
4.NBT.1. Recognize that in a multi-digit whole number, a digit		The MMFR does not specify that students recognize that a digit in one

Common Core State Standards for Mathematics	*2007 MS Mathematics Framework Revised*	Comments
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.*[2]		place represents ten times what it represents in the place to its right.
4.NBT.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.[2]	4.1.j. Compose and decompose five-digit numbers and decimals numbers through hundredths, with representations in words, physical models, and expanded and standard forms. (DOK 1)	Comparing two multi-digit numbers based on meanings of the digits in each place, using >, =, and < symbols is found at grade 3.1.b.
4.NBT.3. Use place value understanding to round multi-digit whole numbers to any place.[2]	4.1.h. Estimate products and quotients of whole numbers to include strategies such as rounding. (DOK 2)	
4.NBT.4. Fluently add and subtract multi-digit whole numbers using the standard algorithm.[2]	4.1.a. Add and subtract up to five-digit whole numbers with and without regrouping. (DOK 1)	
4.NBT.5. Multiply a whole number of up to four digits by a one-digit whole number, and multiply two two-digit numbers, using strategies based on place value and the properties of operations. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.[2]		The MMFR does not specify that students multiply four-digit whole numbers until grade 6.1.i.
4.NBT.6. Find whole-number quotients and remainders with up to four-digit dividends and one-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.	4.1.d. Explain two or more methods of dividing four-digit dividends by one- and two-digit divisors, with and without remainders, and justify the processes. (DOK 2)	The MMFR does not specify that students illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.

[2]Grade 4 expectations in this domain are limited to whole numbers less than or equal to 1,000,000.

Common Core State Standards for Mathematics	***2007 MS Mathematics Framework Revised***	**Comments**
4.NF.1. Explain why a fraction *a/b* is equivalent to a fraction *(n × a)/(n × b)* by using visual fraction models, with attention to how the number and size of the parts differ even though the two fractions themselves are the same size. Use this principle to recognize and generate equivalent fractions.[3]	4.1.f. Model and identify equivalent fractions. (DOK 2)	The MMFR does not specify that students explain why fractions are equivalent.
4.NF.2. Compare two fractions with different numerators and different denominators, e.g., by creating common denominators or numerators, or by comparing to a benchmark fraction such as 1/2. Recognize that comparisons are valid only when the two fractions refer to the same whole. Record the results of comparisons with symbols >, =, or <, and justify the conclusions, e.g., by using a visual fraction model.[3]	4.1.k. Determine and use benchmark numbers such as 0, 0.5, (1/2), and 1 to judge the magnitude of whole numbers, decimals, and fractions. (DOK 2)	The MMFR does not specify that students compare fractions with different numerators. The framework does not specify that students compare like and unlike fractions using >, =, or <, until grade 5.1.a.
4.NF.3. Understand a fraction a/b with a > 1 as a sum of fractions 1/b.[3] a. Understand addition and subtraction of fractions as joining and separating parts referring to the same whole. b. Decompose a fraction into a sum of fractions with the same denominator in more than one way, recording each decomposition by an equation. Justify decompositions, e.g., by using a visual fraction model. *Examples: 3/8 = 1/8 + 1/8 + 1/8;* *3/8 = 1/8 + 2/8; 2 1/8 = 1 + 1 + 1/8 = 8/8 + 8/8 + 1/8.* 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.	4.1.e. Add and subtract fractions with like denominators. (DOK 1)	The MMFR does not specify that students understand addition and subtraction of fractions as joining and separating parts of the same whole or decompose fractions with the same denominator in more than one way. The framework does not specify that students add and subtract mixed numbers until grade 6.1.d. Solving word problems, as mentioned in the CCSS, is not included in the MMFR.

Common Core State Standards for Mathematics	***2007 MS Mathematics Framework Revised***	**Comments**
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.		
4.NF.4 Apply and extend previous understandings of multiplication to multiply a fraction by a whole number.[3] a. Understand a fraction *a/b* as a multiple of *1/b. For example, use a visual fraction model to represent 5/4 as the product 5 × (1/4), recording the conclusion by the equation 5/4 = 5 × (1/4).* b. Understand a multiple of *a/b* as a multiple of 1/*b*, and use this understanding to multiply a fraction by a whole number. *For example, use a visual fraction model to express 3 × (2/5) as 6 × (1/5), recognizing this product as 6/5. (In general, n × (a/b) = (n × a)/b.)* c. Solve word problems involving multiplication of a fraction by a whole number, e.g., by using visual fraction models and equations to represent the problem. *For example, if each person at a party will eat 3/8 of a pound of roast beef, and there will be 5 people at the party, how many pounds of roast beef will be needed? Between what two whole numbers does your answer lie?*		The MMFR does not specify at any grade level multiplying a fraction by a whole number using visual fraction models. Solving word problems, as mentioned in the CCSS, is not included in the MMFR.
4.NF.5. Express a fraction with denominator 10 as an equivalent fraction with denominator 100, and use this technique to add two fractions with respective denominators 10 and 100.[4] *For example, express 3/10 as 30/100, and add 3/10 + 4/100 = 34/100.*		The MMFR does not use the technique of place value conversion in denominators to add two fractions.
4.NF.6.	4.1.g	

Common Core State Standards for Mathematics	***2007 MS Mathematics Framework Revised***	**Comments**
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*.[3]	Represent equivalence relationships between fractions and decimals using concrete materials, diagrams, or other models. (DOK 1)	
4.NF.7. Compare two decimals to hundredths by reasoning about their size. Recognize that comparisons are valid only when the two decimals refer to the same whole. Record the results of comparisons with the symbols >, =, or <, and justify the conclusions, e.g., by using a visual model.[3]	4.1.g. Represent equivalence relationships between fractions and decimals using concrete materials, diagrams, or other models. (DOK 1) 4.1.j. Compose and decompose five-digit numbers and decimal numbers through hundredths, with representations in words, physical models, and expanded and standard forms. (DOK 1)	The MMFR does not specify that students recognize that decimal comparisons are valid only when the two decimals refer to the same whole number. The MMFR does not specify that students use >, =, or < in comparing decimals to hundredths until grade 5.1.a.
4.MD.1. Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit. Record measurement equivalents in a two-column table. *For example, know that 1 ft is 12 times as long as 1 in. Express the length of a 4 ft snake as 48 in. Generate a conversion table for feet and inches listing the number pairs (1, 12), (2, 24), (3, 36),...*	4.4.b. Convert capacity, weight/mass, and length <u>within</u> the English and metric systems of measurement. (DOK 1)	

[3] Grade 4 expectations in this domain are limited to fractions with denominators 2, 3, 4, 5, 6, 8,10,12, and 100.
[4] Students who can generate equivalent fractions can develop strategies for adding fractions with unlike denominators in general. But addition and subtraction with un-like denominators in general is not a requirement at this grade.

4.MD.2. Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money, including problems involving simple fractions or decimals, and problems that require expressing measurements given in a larger unit in terms of a smaller unit. Represent measurement quantities using diagrams such as	4.1.a. Add and subtract up to five-digit whole numbers with and without regrouping. (DOK 1) 4.1.b. Add and subtract decimals through hundredths. (DOK 1) 4.1.c. Explain two or more methods of multiplying	Solving word problems, as mentioned in the CCSS, is not included in the MMFR; however, the grade 4.4.d objective does include problems in real-life situations. Many objectives in the grade 4 MMFR use the four operations to solve problems using whole numbers, fractions, and

Common Core State Standards for Mathematics	***2007 MS Mathematics Framework Revised***	**Comments**
number line diagrams that feature a measurement scale.	whole numbers (one- and two-digits) with justification. (DOK 2) 4.1.d. Explain two or more methods of dividing four digit dividends by one- and two-digit divisors, with and without remainders, and justify the process. (DOK 2) 4.1.e. Add and subtract fractions with like denominators. (DOK 1) 4.4.b. Convert capacity, weight/mass, and length <u>within</u> the English and metric systems of measurement. (DOK 1) 4.4.d. Use appropriate tools to determine, estimate, and compare units for measurement of weight/mass, area, size of angle, temperature, length, distance, and volume in English and metric systems and time in real-life situations.	decimals. However, the objectives do not specify that the problems involve money. The MMFR does not specify that students multiply and divide with fractions and decimals until grade 5.1.f. The framework does not specify that students represent measurement quantities using diagrams such as number line diagrams that feature a measurement scale.
4.MD.3. Apply the area and perimeter formulas for rectangles in real-world and mathematical problems. *For example, find the width of a rectangular room given the area of the flooring and the length, by viewing the area formula as a multiplication equation with an unknown factor.*	4.4.c. Describe relationships of rectangular area to numerical multiplication. (DOK 2)	The MMFR does not specify that students use the area and perimeter formulas until grade 5.4.c. The framework does not specify that students use the area formula as a multiplication equation with an unknown factor until grade 6.4.f.
4.MD.4. Make a line plot to display a data set of measurements in fractions of a unit (1/2, 1/4, 1/8). Solve problems involving addition and subtraction of fractions by using information presented in line plots. *For example, from a line plot find and interpret the difference in length between the longest and shortest specimens in an insect collection.*	4.5.a. Draw, label, and interpret bar graphs, line graphs, and stem-and-leaf plots. (DOK 2) 4.5.c. Compare data and interpret quantities represented on tables and graphs including line graphs, bar graphs, frequency tables, and stem-and-leaf plots to make predictions and solve problems based on the information. (DOK 3)	The MMFR does not specify line plot data sets in fractions of a unit.

Common Core State Standards for Mathematics	***2007 MS Mathematics Framework Revised***	**Comments**
4.MD.5. Recognize angles as geometric shapes that are formed wherever two rays share a common endpoint, and understand concepts of angle measurement: a. An angle is measured with reference to a circle with its center at the common endpoint of the rays, by considering the fraction of the circular arc between the points where the two rays intersect the circle. An angle that turns through 1/360 of a circle is called a “one-degree angle,” and can be used to measure angles. b. An angle that turns through *n* one-degree angles is said to have an angle measure of *n* degrees.	4.3.b. Identify and analyze the relationships between and among points, lines, line segments, angles, and rays. (DOK 2) 4.4.d. Use appropriate tools to determine, estimate, and compare units for measurement of weight/mass, area, size of angle, temperature, length, distance, and volume in English and metric systems and time in real-life situations. (DOK 1)	The MMFR does not specify that an angle is measured with reference to a circle with its center at the common endpoint of the rays, by considering the fraction of the circular arc between the points where the two rays intersect the circle.
4.MD.6. Measure angles in whole-number degrees using a protractor. Sketch angles of specified measure.	4.4.d. Use appropriate tools to determine, estimate, and compare units for measurement of weight/mass, area, size of angle, temperature, length, distance, and volume in English and metric systems and time in real-life situations. (DOK 1)	
4.MD.7. Recognize angle measure as additive. When an angle is decomposed into non-overlapping parts, the angle measure of the whole is the sum of the angle measures of the parts. Solve addition and subtraction problems to find unknown angles on a diagram in real-world and mathematical problems, e.g., by using an equation with a symbol for the unknown angle measure.		The MMFR does not specify that students decompose an angle into non-overlapping parts.
4.G.1. Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures.	4.3.a. Analyze and describe the similarities and differences between and among two- and three-dimensional geometric shapes, figures, and models using mathematical language.	The MMFR does not specify that students classify angles as right, acute, or obtuse until grade 6.3.d. The framework does not specify parallel and perpendicular

Common Core State Standards for Mathematics	*2007 MS Mathematics Framework Revised*	Comments
	(DOK 2) 4.3.b. Identify and analyze the relationships between and among points, lines, line segments, angles, and rays. (DOK 2)	terminology until Pre-Algebra 3.a.
4.G.2. Classify two-dimensional figures based on the presence or absence of parallel or perpendicular lines or the presence or absence of angles of a specified size. Recognize right triangles as a category, and identify right triangles.		The MMFR does not specify parallel and perpendicular terminology until Pre-Algebra 3.a. The framework does not specify that students classify angles as right, acute, or obtuse until grade 6.3.d.
4.G.3. Recognize a line of symmetry for a two-dimensional figure as a line across the figure such that the figure can be folded along the line into matching parts. Identify line-symmetric figures and draw lines of symmetry.		The MMFR does not specify that students recognize a line of symmetry until grade 5.3.a. and 5.3.d.
	4.1.i. Recall multiplication and division facts. (DOK 1)	Fluently multiplying and dividing with 100 is found in grade 3 in the CCSS.
	4.2.c. Construct input/output function tables and generalize the rule using words, models, and symbols. (DOK 3)	The definition of function begins at the 8th grade in the CCSS.
	4.2.d. Explain the properties of the basic operations using models, numbers, and variables: (DOK 2) - Zero property of multiplication - Associative properties of addition and multiplication - Commutative properties of addition and multiplication - Identity properties of addition and multiplication - Distributive properties of multiplication over addition and subtraction	Understanding the properties of operations in addition and subtraction begins in grade 1 in the CCSS. Gaining a foundation in multiplication begins in grade 2, and representing and solving problems involving multiplication and division are found in grade 3 in the CCSS.

Common Core State Standards for Mathematics	*2007 MS Mathematics Framework Revised*	Comments
	4.2.e. Demonstrate and explain the inverse operations of addition/subtraction and multiplication/division. (DOK 2)	The CCSS defines inverse operations in 8th grade.
	4.3.c. Identify transformations (rotations [turns], reflections [flips], and translations [slides]) of two-dimensional figures. (DOK 1)	Transformations are found at the 8th grade level in the CCSS.
	4.3.d. Locate ordered pairs in the first quadrant of the coordinate plane. (DOK 1)	The coordinate system is defined at 5th grade in the CCSS.
	4.4.a. Estimate and measure a given object to the nearest eighth of an inch. (DOK 2)	Estimating and measuring given objects begins at 2nd grade in the CCSS, but not to the nearest eighth of an inch.
	4.5.b. Find and interpret the mean, mode, median, and range of a set of data. (DOK 1)	Working with measures of central tendency begins at the 6th grade in the CCSS.

COMMON CORE STATE STANDARDS (CCSS) FOR MATHEMATICS
2007 MISSISSIPPI MATHEMATICS FRAMEWORK REVISED (MMFR)
ALIGNMENT ANALYSIS
Grade 5

CCSS Key:
Operations and Algebraic Thinking (OA)
Number and Operations in Base Ten (NBT)
Numbers and Operations–Fractions (NF)
Measurement and Data (MD)
Geometry (G)

MMFR Content Standards Key:
Numbers and Operations (1)
Algebra (2)
Geometry (3)
Measurement (4)
Data Analysis and Probability (5)
Depth of Knowledge (DOK)

Common Core State Standards for Mathematics	*2007 MS Mathematics Framework Revised*	Comments
5.OA.1. Use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols.		Using the order of operations to simplify and/or evaluate whole numbers (including exponents and grouping symbols) is found in the MMFR at grade 7.1.a.
5.OA.2. Write simple expressions that record calculations with numbers and interpret numerical expressions without evaluating them. *For 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.*		Writing simple expressions that record calculations with numbers and interpreting numerical expressions are found in the MMFR at grade 6.2.c.
5.OA.3. Generate two numerical patterns using two given rules. Identify apparent relationships between corresponding terms. Form ordered pairs consisting of corresponding terms from the two patterns, and graph the ordered pairs on a coordinate plane. *For example, given the rule "Add 3" and the starting number 0, and given the rule "Add 6" and the starting number 0, generate terms in the resulting sequences, and observe that the terms in one*	5.3.b. Explain the relationships between coordinates in each quadrant of the coordinate plane. (DOK 2) 5.3.e. Label ordered pairs in the coordinate plane. (DOK 1)	The MMFR does not specify that students generate two numerical patterns using two given rules.

Common Core State Standards for Mathematics	*2007 MS Mathematics Framework Revised*	Comments
sequence are twice the corresponding terms in the other sequence. Explain informally why this is so.		
5.NBT.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.	5.1.b. Compose and decompose seven-digit numbers and decimals through thousandths in word, standard, and expanded forms. (DOK 1)	The MMFR does not specify that students recognize that a digit in one place represents 10 times as much as it represents in the place to its right and 1/10 of what is represents in the place to its left.
5.NBT.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.		The MMFR does not specify that students explain patterns in the number of zeros of the product when multiplying or dividing by a power of 10.
5.NBT.3. Read, write, and compare decimals to thousandths. a. Read and write decimals to thousandths using base-ten numerals, number names, and expanded form, e.g., 347.392 = 3 × 100 + 4 × 10 + 7 × 1 + 3 × (1/10) + 9 × (1/100) + 2 × (1/1000). b. Compare two decimals to thousandths based on meanings of the digits in each place, using >, =, and < symbols to record the results of comparisons.	5.1.b. Compose and decompose seven-digit numbers and decimals through thousandths in word, standard, and expanded forms. (DOK 1) 5.1.a. Compare and order integers, decimals to the nearest thousandths, like and unlike fractions, and mixed numbers using >, <, and =. (DOK 1)	
5.NBT.4. Use place value understanding to round decimals to any place.	5.1.g. Estimate sums, differences, products, and quotients of nonnegative rational numbers to include strategies such as front-end rounding, benchmark numbers, compatible numbers, and rounding. (DOK 2)	
5.NBT.5. Fluently multiply multi-digit whole numbers using the standard algorithm.	5.1.f. Add, subtract, multiply, and divide (with and without remainders) using nonnegative rational numbers. (DOK 1)	

Common Core State Standards for Mathematics	***2007 MS Mathematics Framework Revised***	**Comments**
5.NBT.6. Find whole-number quotients of whole numbers with up to four-digit dividends and two-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.	5.1.f. Add, subtract, multiply, and divide (with and without remainders) using nonnegative rational numbers. (DOK 1) 5.1.d. Apply inverse operations of addition/subtraction and multiplication/division to problem-solving situations. (DOK 2) 5.2.a. Determine the value of variables in equations and inequalities, justifying the process. (DOK 2)	The MMFR specifies that students find whole number quotients of whole numbers with up to four-digit dividends and two-digit divisors at grade 4.1.d.
5.NBT.7. Add, subtract, multiply, and divide decimals to hundredths, 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.	5.1.f. Add, subtract, multiply, and divide (with and without remainders) using nonnegative rational numbers. (DOK 1) 5.2.c. Apply the properties of basic operations to solve problems: (DOK 2) - Zero property of multiplication - Commutative properties of addition and multiplication - Associative properties of addition and multiplication - Distributive properties of multiplication over addition and subtraction - Identity properties of addition and multiplication 5.2.d. Apply inverse operations of addition/subtraction and multiplication/division to problem-solving situations. (DOK 2)	The MMFR does not specify that students use concrete models or drawings and strategies based on place value when adding, subtracting, multiplying, and dividing decimals to hundredths.
5.NF.1. Add and subtract fractions with unlike denominators (including mixed numbers) by replacing given fractions with equivalent fractions in such a way as to produce an equivalent sum or difference of fractions with like denominators. *For example, 2/3 +*	5.1.f. Add, subtract, multiply, and divide (with and without remainders) using nonnegative rational numbers. (DOK 1)	

Common Core State Standards for Mathematics	*2007 MS Mathematics Framework Revised*	Comments
5/4 = 8/12 + 15/12 = 23/12. (In general, a/b + c/d = (ad + bc)/bd.)		
5.NF.2. Solve word problems involving addition and subtraction of fractions referring to the same whole, including cases of unlike denominators, e.g., by using visual fraction models or equations to represent the problem. Use benchmark fractions and number sense of fractions to estimate mentally and assess the reasonableness of answers. *For example, recognize an incorrect result 2/5 + 1/2 = 3/7, by observing that 3/7 < 1/2.*	5.1.f. Add, subtract, multiply, and divide (with and without remainders) using nonnegative rational numbers. (DOK 1) 5.2.a. Determine the value of variables in equations and inequalities, justifying the process. (DOK 2) 5.1.g. Estimate sums, differences, products, and quotients of nonnegative rational numbers to include strategies such as front-end rounding, benchmark numbers, compatible numbers, and rounding. (DOK 2)	The MMFR does not specify that students solve word problems. The MMFR specifies that students use benchmark fractions to judge the magnitude of fractions at grade 4.1.k.
5.NF.3. Interpret a fraction as division of the numerator by the denominator *(a/b = a ÷ b).* Solve word problems involving division of whole numbers leading to answers in the form of fractions or mixed numbers, e.g., by using visual fraction models or equations to 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 numbers does your answer lie?*	5.1.e. Model and identify equivalent fractions including conversion of improper fractions to mixed numbers and vice versa. (DOK 1) 5.1.f. Add, subtract, multiply, and divide (with and without remainders) using nonnegative rational numbers. (DOK 1) 5.2.a. Determine the value of variables in equations and inequalities, justifying the process. (DOK 2) 5.2.d. Apply inverse operations of addition/subtraction and multiplication/division to problem-solving situations. (DOK 2)	The MMFR does not specify that students explain the meaning of the division of rational numbers until grade 6.1.j. The MMFR does not specify that students solve word problems.
5.NF.4. Apply and extend previous understandings of multiplication to multiply a fraction or whole number by a fraction. a. Interpret the product *(a/b)* × *q* as *a* parts of a	5.1.f. Add, subtract, multiply, and divide (with and without remainders) using nonnegative rational numbers. (DOK 1) 5.4.c. Develop, compare, and use formulas to	The MMFR does not specify that students interpret multiplying a fraction and a whole number as parts of a partition. The MMFR does not specify that students find the area of a rectangle with fractional side

Common Core State Standards for Mathematics	*2007 MS Mathematics Framework Revised*	Comments
partition of *q* into *b* equal parts; equivalently, as the result of a sequence of operations *a* × *q* ÷ *b. For example, use a visual fraction model to show (2/3) × 4 = 8/3, and create a story context for this equation. Do the same with (2/3) × (4/5) = 8/15. (In general, (a/b) × (c/d) = ac/bd.)* b. Find the area of a rectangle with fractional side lengths by tiling it with unit squares of the appropriate unit fraction side lengths, and show that the area is the same as would be found by multiplying the side lengths. Multiply fractional side lengths to find areas of rectangles, and represent fraction products as rectangular areas.	estimate and calculate the perimeter and area of rectangles, triangles, and parallelograms. (DOK 2)	lengths by tiling it with unit squares of the appropriate unit fraction side lengths.
5.NF.5. Interpret multiplication as scaling (resizing), by: a. 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. b. Explaining why multiplying a given number by a fraction greater than 1 results in a product greater than the given number (recognizing multiplication by whole numbers greater than 1 as a familiar case); explaining why multiplying a given number by a fraction less than 1 results in a product smaller than the given number; and relating the principle of fraction equivalence *a/b = (n×a)/(n×b*) to the effect of multiplying *a/b* by 1.	5.1.g. Estimate sums, differences, products, and quotients of nonnegative rational numbers to include strategies such as front-end rounding, benchmark numbers, compatible numbers, and rounding. (DOK 2)	The MMFR does not specify that students explain the meaning of multiplication of rational numbers until grade 6.1.j. Grade 6.4.d. specifies that students use scale factors to perform dilations and to solve ratio and proportion problems.
5.NF.6. Solve real-world problems involving multiplication of fractions and mixed numbers, e.g., by using visual fraction models or equations to represent the problem.	5.1.f. Add, subtract, multiply, and divide (with and without remainders) using nonnegative rational numbers. (DOK 1) 5.2.a. Determine the value of variables in equations and inequalities, justifying the process. (DOK 2)	The MMFR does not specify that students solve real-world problems.

Common Core State Standards for Mathematics	*2007 MS Mathematics Framework Revised*	Comments
5.NF.7. Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions.[1] a. Interpret division of a unit fraction by a non-zero whole number, and compute such quotients. *For example, 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.*[1] b. Interpret division of a whole number by a unit fraction, and compute such quotients. *For example, 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.* c. Solve real-world problems involving division of unit fractions by non-zero whole numbers and division of whole numbers by unit fractions, e.g., by using visual fraction models and equations to represent the problem. *For example, 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?*	5.1.f. Add, subtract, multiply, and divide (with and without remainders) using nonnegative rational numbers. (DOK 1) 5.2.d. Apply inverse operations of addition/subtraction and multiplication/division to problem-solving situations. (DOK 2) 5.2.a. Determine the value of variables in equations and inequalities, justifying the process. (DOK 2)	The MMFR does not specify that students explain the meaning of the division of rational numbers until grade 6.1.j. Grade 6.2.c. specifies that students formulate algebraic expressions, equations, and inequalities to reflect a given situation.
5.MD.1. Convert among different-sized standard measurement units within a given measurement system (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real-world problems.	5.4.b. Convert units within a given measurement system to include length, weight/mass, and volume. (DOK 1)	The MMFR does not specify that students use conversions to solve problems until grade 6.4.a.

[1]Students able to multiply fractions in general can develop strategies to divide fractions in general, by reasoning about the relationship between multiplication and division. But division of a fraction by a fraction is not a requirement at this grade.

Common Core State Standards for Mathematics	***2007 MS Mathematics Framework Revised***	**Comments**
5.MD.2. Make a line plot to display a data set of measurements in fractions of a unit (1/2, 1/4, 1/8). Use operations on fractions for this grade to solve problems involving information presented in line plots. *For 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.*	5.5.b. Compare data and interpret quantities represented on tables and graphs, including line graphs, stem-and-leaf plots, histograms, and box-and-whisker plots to make predictions, and solve problems based on the information. (DOK 2) 5.1.f. Add, subtract, multiply, and divide (with and without remainders) using nonnegative rational numbers. (DOK 1)	The MMFR does not specify that students make a line plot to display a data set of measurement in fractions. However, students are using the four operations on fractions at this grade level.
5.MD.3. Recognize volume as an attribute of solid figures and understand concepts of volume measurement. a. A cube with side length 1 unit, called a “unit cube,” is said to have “one cubic unit” of volume, and can be used to measure volume. b. A solid figure which can be packed without gaps or overlaps using *n* unit cubes is said to have a volume of *n* cubic units.	5.4.b. Convert units within a given measurement system to include length, weight/mass, and volume. (DOK 1) 5.4.d. Select and apply appropriate units for measuring length, mass, volume, and temperature in the standard (English and metric) systems. (DOK 1) 5.3.d. Construct and analyze two- and three-dimensional shapes to solve problems involving congruence and symmetry. (DOK 3)	
5.MD.4. Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft, and improvised units.	5.4.d. Select and apply appropriate units for measuring length, mass, volume, and temperature in the standard (English and metric) systems. (DOK 1)	The MMFR does not specify that students measure volume by counting unit cubes.
5.MD.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,	5.4.d. Select and apply appropriate units for measuring length, mass, volume, and temperature in the standard (English and metric) systems. (DOK 1) 5.4.b. Convert units within a given measurement system to include length, weight/mass, and volume. (DOK 1)	The MMFR does not specify that students: - Find the volume of a prism by packing it with unit cubes - Recognize volume as additive The MMFR does not specify that students justify formulas for volume until grade 7.4.c.

Common Core State Standards for Mathematics	*2007 MS Mathematics Framework Revised*	Comments
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 $V = l \times w \times h$ and $V = b \times h$ 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.		
5.G.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).	5.3.b. Explain the relationships between coordinates in each quadrant of the coordinate plane. (DOK2) 5.3.e. Label ordered pairs in the coordinate plane. (DOK 1)	
5.G.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 context of the situation.	5.3.e. Label ordered pairs in the coordinate plane. (DOK 1)	The MMFR does not specify that students represent real-world problems by graphing on the coordinate plane.
5.G.3. Understand that attributes belonging to a category of two-dimensional figures also belong to all	5.3.a. Analyze and describe the characteristics of symmetry relative to classes of polygons	The MMFR specifies that students analyze and describe the similarities and differences between and among

Common Core State Standards for Mathematics	***2007 MS Mathematics Framework Revised***	**Comments**
subcategories of that category. *For example, all rectangles have four right angles and squares are rectangles, so all squares have four right angles.*	(parallelograms, triangles, etc.) (DOK 2) 5.3.d. Construct and analyze two- and three-dimensional shapes to solve problems involving congruence and symmetry. (DOK 3)	two- and three-dimensional geometric shapes, figures, and models using mathematical language at grade 4.3.a.
5.G.4. Classify two-dimensional figures in a hierarchy based on properties.	5.3.a. Analyze and describe the characteristics of symmetry relative to classes of polygons (parallelograms, triangles, etc.) (DOK 2) 5.3.d. Construct and analyze two- and three-dimensional shapes to solve problems involving congruence and symmetry. (DOK 3)	The MMFR specifies that students analyze and describe the similarities and differences between and among two- and three-dimensional geometric shapes, figures, and models using mathematical language at grade 4.3.a.
	5.1.c. Identify factors and multiples of whole numbers. (DOK 1)	Understanding division as an unknown-factor problem is in the 3rd grade in the CCSS.
	5.2.b. Devise a rule for an input/output function table, describing it in words and symbols. (DOK 2)	The definition of function is found in the CCSS in the 8th grade.
	5.3.c. Describe the characteristics, including the relationship of the pre-image and the image, of each type of transformation (rotations [turns], reflections [flips], and translations [slides]) of two-dimensional figures. (DOK 2)	Transformations are found in the 8th grade in the CCSS.
	5.4.a. Estimate and measure length to nearest millimeter in the metric system and one-sixteenth inch in the English system. (DOK 2)	Estimating length using inches, feet, centimeters, and meters is found in 2nd grade in the CCSS.
	5.5.a. Use the mean, median, mode, and range to analyze a data set. (DOK 2)	Using measures of central tendency is found at 6th grade in the CCSS.

COMMON CORE STATE STANDARDS (CCSS) FOR MATHEMATICS
2007 MISSISSIPPI MATHEMATICS FRAMEWORK REVISED (MMFR)
ALIGNMENT ANALYSIS
Grade 6

CCSS Domains Key:
Ratios and Proportional Relationships (RP)
The Number System (NS)
Expressions and Equations (EE)
Geometry (G)
Statistics and Probability (SP)

MMFR Content Standards Key:
Numbers and Operations (1)
Algebra (2)
Geometry (3)
Measurement (4)
Data Analysis and Probability (5)
Depth of Knowledge (DOK)

Common Core State Standards for Mathematics	*2007 MS Mathematics Framework Revised*	Comments
6.RP.1. Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. For example, *"The ratio of wings to beaks in the bird house at the zoo was 2:1, because for every 2 wings there was 1 beak." "For every vote candidate A received, candidate C received nearly three votes."*		MMFR objectives address ratio at grade 7 focusing on solving problems on ratio and proportion (DOK 2), a skill that would follow "understand the concept of a ratio." There is, however, no MMFR objective at the 6th grade level addressing understanding the concept of a ratio or the use of ratio language.
6.RP 2. Understand the concept of a unit rate *a/b* associated with a ratio *a:b*, with $b \neq 0$, and use rate language in the context of a ratio relationship. *For example, "This recipe has a ratio of 3 cups of flour to 4 cups of sugar, so there is 3/4 cup of flour for each cup of sugar." "We paid $75 for 15 hamburgers, which is a rate of $5 per hamburger."*[1]		MMFR objectives address unit rates at grade 7 focusing on solving real-life problems involving unit price, unit rate, sales price, etc. (DOK 1). There is, however, no MMFR objective at the 6th grade level addressing understanding the concept of unit rate.

[1]Expectations for unit rates in this grade are limited to non-complex fractions.

Common Core State Standards for Mathematics	***2007 MS Mathematics Framework Revised***	**Comments**
6.RP 3. Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations. a. Make tables of relating quantities with whole-number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios. b. Solve unit rate problems including those involving unit pricing and constant speed. *For example, if it took 7 hours to mow 4 lawns, then at that rate, how many lawns could be mowed in 35 hours? At what rate were lawns being mowed?* c. Find a percent of a quantity as a rate per 100 (e.g., 30% of a per 100 (e.g. 30% of a quantity means 30/100 times the quantity), solve problems involving finding the whole, given a part and the percent. d. Use ratio reasoning to convert measurement units; manipulate measurement units, manipulate and transform units appropriately when multiplying or dividing quantities.	6.6.d. Use scale factors to perform dilations and to solve ratio and proportion problems. (DOK 2) 6.1.h. Solve problems by finding the percentage of a number including percentages greater than 100 and less than 1. (DOK 2) 6.4.a. Convert units within a given measurement system to solve problems. (DOK 1)	The MMFR objective is in the Geometry content strand at this grade level. It is not a perfect match, but it alludes to ratio and proportion. There is an MMFR grade 8 objective about developing, analyzing, and explaining methods for solving problems involving proportions, such as scaling and finding equivalent ratios. This set of CCSS from a. to d. indicates the use of the concept of ratios, unit rates, etc. in a variety of situations, such as measurement conversion, unit pricing, constant speed, and percent. While both the CCSS and the MMFR objective focus on finding the percent of a quantity, the CCSS is explicit on using rate per 100. The CCSS is explicit in the use of ratio reasoning to convert, manipulate, and transform measurement units while the MMFR objective is about conversion of units.
6.NS.1. Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions, e.g., by using visual fraction models and	6.1.d. Compute using basic operations with fractions and mixed numbers. Express answers in the simplest form. (DOK 1)	Solving word problems, as mentioned in the CCSS, is not included in the MMFR. While it is possible for students to be able to interpret when

Common Core State Standards for Mathematics	*2007 MS Mathematics Framework Revised*	Comments
equations to represent the problem. *For example, create a story context for (2/3) ÷ (3/4) and use a visual fraction model to show the quotient; use the relationship between multiplication and division to explain that (2/3) ÷ (3/4) = 8/9 because 3/4 of 8/9 is 2/3. (In general, (a/b) ÷ (c/d) = ad/bc). How much chocolate will each person get if 3 people share 1/2 lb of chocolate equally? How many 3/4-cup servings are in 2/3 of a cup of yogurt? How wide is a rectangular strip of land with length 3/4 mi and area 1/2 square mi?*	6.1.j. Explain the meaning of multiplication and division of rational numbers. (DOK 2)	computing, the MMFR objective appears to focus on the basic skill of computing (DOK 1). The examples provided in the CCSS appear to elicit a deeper understanding of the relationship between multiplication and division.
6.NS.2. Fluently divide multi-digit numbers using the standard algorithm.	6.1.i. Multiply four-digit numbers by two-digit numbers (including whole numbers and decimals). (DOK 1) 6.1.e. Solve problems by dividing whole and decimal numbers by decimals, and interpret the quotient and remainder within the problem context. (DOK 2)	The CCSS stressed the use of the standard algorithm.
6.NS.3. Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation.		
6.NS.4. Find the greatest common factor of two whole numbers less than or equal to 100 and the least common multiple of two whole numbers less than or equal to 12. Use the distributive property to express a sum of two whole numbers 1–100 with a common factor as a multiple of a sum of two whole numbers with no common factor. *For example, express 36 + 8 as 4 (9 + 2).*	6.1.c. Determine the Greatest Common Factor (GCF) and Least Common Multiple (LCM) of two numbers. (DOK 2)	The CCSS provides guidance on how to determine the GCF and the LCM. The MMFR objective does not.
6.NS.5. Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below	6.1.g. Model addition and subtraction of integers with physical materials and the number line. (DOK 2)	The CCSS provides guidance and examples about developing understanding positive and negative numbers but does not concentrate on

Common Core State Standards for Mathematics	***2007 MS Mathematics Framework Revised***	**Comments**
zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation.		operations.
6.NS.6. Understand a rational number as a point on the number line. Extend number line diagrams and coordinate axes familiar from previous grades to represent points on the line and in the plane with negative number coordinates. a. Recognize opposite signs of numbers as indicating locations on opposite sides of 0 on the number line; recognize that the opposite of the opposite of a number is the number itself, e.g., -(-3) = 3, and that 0 is its own opposite. b. Understand signs of numbers in ordered pairs as indicating locations in quadrants of the coordinate plane; recognize that when two ordered pairs differ only by signs, the locations of the points are related by reflections across one or both axes. c. Find and position integers and other rational numbers on a horizontal or vertical number line diagram; find and position pairs of integers and other rational numbers on a coordinate plane.	6.1.g. Model addition and subtraction of integers with physical materials and the number line. (DOK 2)	The focus of the CCSS is the conceptual development about understanding signs of numbers on the number line and in the coordinate plane.
6.NS.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*	6.1.a. Compare and order rational numbers using symbols (<, >, and =) and a number line. (DOK 1)	The CCSS provides guidance and examples in understanding ordering and comparing rational numbers using the number line and the coordinate plane. It also includes applications for absolute value.

Common Core State Standards for Mathematics	*2007 MS Mathematics Framework Revised*	Comments
as a statement that -3 is located to the right of -7 on a number line oriented from left to right. b. Write, interpret, and explain statements of order for rational numbers in real-world contexts. *For example, write -3°C > -7°C to express the fact that -3°C is warmer than -7°C.* c. Understand the absolute value of a rational number as its distance from 0 on the number line; interpret absolute value as magnitude for a positive or negative quantity in a real-world situation. *For example, for an account balance of -30 dollars, write |-30| = 30 to describe the size of the debt in dollars.* d. Distinguish comparisons of absolute value from statements about order. For example, recognize that an account balance less than -30 dollars represents a debt greater than 30 dollars.	6.1.k. Explain the meaning and relationship between absolute value and opposites. (DOK 2)	
6.NS.8. Solve real-world and mathematical problems by graphing points in all four quadrants of the coordinate plane. Include use of coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate.		Use of the distance formula is included in the Transitions to Algebra, Algebra I, and Geometry MMFR.
6.EE.1. Write and evaluate numerical expressions involving whole-number exponents.		There is no MMFR objective addressing exponents at this grade level or at the 5^{th} grade level. The first objective in grade 7 includes exponents and grouping symbols in the use of the order of operations to simplify and evaluate whole numbers.

Common Core State Standards for Mathematics	*2007 MS Mathematics Framework Revised*	Comments
6.EE.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. *For example, express the calculation "Subtract y from 5" as 5 - y.* b. Identify parts of an expression using mathematical terms (sum, term, product, factor, quotient, coefficient); view one or more parts of an expression as a single entity. *For example, describe the expression 2 (8 + 7) as a product of two factors; view (8 + 7) as both a single entity and a sum of two terms.* c. Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used in real-world problems. Perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations). *For example, use the formulas* $V = s^3$ *and* $A = 6\ s^2$ *to find the volume and surface area of a cube with sides of length s = 1/2.*	6.2.c. Formulate algebraic expressions, equations, and inequalities to reflect a given situation. (DOK 2)	The four sections of this CCSS focus on writing, reading, and evaluating expressions in a sequence of steps, while the MMFR objective is inclusive—formulating expressions, equations, and equalities.
6.EE.3. Apply the properties of operations to generate equivalent expressions. *For example, apply the distributive property to the expression 3 (2 + x) to produce the equivalent expression 6 + 3x; apply the distributive property to the expression 24x + 18y to produce the equivalent expression 6 (4x + 3y); apply properties of operations to y + y + y to produce the equivalent expression 3y.*	6.2.d. State the following properties using variables and apply them in solving problems: (DOK 1) • Zero property of multiplication • Inverse properties of addition/subtraction and multiplication/division • Commutative and associative properties of addition and multiplication • Identity properties of addition and multiplication	The CCSS uses the properties of operations to generate equivalent expressions, while the MMFR objective implies recall and application of properties of operations.

Common Core State Standards for Mathematics	*2007 MS Mathematics Framework Revised*	Comments
	• Distributive properties of multiplication over addition and subtraction.	
6.EE.4. Identify when two expressions are equivalent (i.e., when the two expressions name the same number regardless of which value is substituted into them). *For example, the expressions y + y + y and 3y are equivalent because they name the same number regardless of which number y stands for.* 6.EE.5. Understand solving an equation or inequality as a process of answering a question: which values from a specified set, if any, make the equation or inequality true? Use substitution to determine whether a given number in a specified set makes an equation or inequality true. 6.EE.6. Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.	6.2.c. Formulate algebraic expressions, equations, and inequalities to reflect a given situation. (DOK 2)	In CCSS 6.EE 4-6, solving an equation includes substitution, answering a question, and the use of variables to represent numbers. The MMFR objective is inclusive, formulating algebraic expressions, equations, and inequalities.
6.EE.7. Solve real-world and mathematical problems by writing and solving equations of the form $x + p = q$ and $px = q$ for cases in which p, q and x are all nonnegative rational numbers.	6.2.a. Solve simple equations using guess-and-check, diagrams, properties, or inspection, explaining the process used. (DOK 2)	The CCSS defines the set to be used, all nonnegative rational numbers.
6.EE.8. Write an inequality of the form $x > c$ represent a constraint or condition in a real-world or mathematical problem. Recognize that inequalities of the form $x > c$ or $x < c$ have infinitely many solutions;	6.2.c. Formulate algebraic expressions, equations, and inequalities to reflect a given situation. (DOK 2)	This MMFR objective is the all-inclusive one and is repeated here because it includes inequalities. The CCSS offers a view of an inequality as a constraint or condition in a real-

Common Core State Standards for Mathematics	***2007 MS Mathematics Framework Revised***	**Comments**
represent solutions of such inequalities on number line diagrams.		world or mathematical problem.
6.EE.9. Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables and relate these to the equation. *For example, in a problem involving motion at constant speed, list and graph ordered pairs of distances and times, and write the equation d = 65t to represent the relationship between distance and time.*		Explaining and illustrating how changes in one variable may result in a change in another variable is an MMFR objective in Transitions to Algebra.
6.G.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.	6.4.b. Calculate the perimeter and area of regular and irregular shapes using a variety of methods. (DOK 2)	The CCSS standard is explicit in the method to be used in finding the area of polygons. It focuses on applying the techniques in the context of both real-world and mathematical problems. The MMFR objective focuses on methods but it does include perimeter.
6.G.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.	6.4.e. Predict and calculate the volume of prisms. (DOK 2)	The MMFR objective is at a higher level (DOK 2) than the CCSS, but the rigor in the CCSS is in the use of fractional edge lengths.

Common Core State Standards for Mathematics	***2007 MS Mathematics Framework Revised***	**Comments**
6.G.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.	6.3.c. Draw, label, and classify polygons to include regular and irregular shapes. Identify congruent and symmetrical figures. (DOK 1)	The CCSS is about polygons in the coordinate plane.
6.G.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.	6.4.f. Apply techniques and tools to accurately find length, area, and angle measures to appropriate levels of precision. (DOK 1)	,The MMFR objective is not explicit about which techniques to use.
6.SP.1. Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answers. *For example, "How old am I?" is not a statistical question, but "How old are the students in my school?" is a statistical question because one anticipates variability in students' ages.* 6.SP.2. Understand that a set of data collected to answer a statistical question has a distribution, which can be described by its center, spread, and overall shape.	6.5.b. Determine how changes in data affect mean, median, mode, and range. (DOK 2)	While this standard may be inferred in the MMFR objective, the MMFR is not explicit in looking at data variability.
6.SP.4. Display numerical data in plots on a number line, including dot plots, histograms, and box plots.	6.5.a. Construct, interpret, and explain line graphs, double bar graphs, frequency plots, stem-and-leaf plots, histograms, and box-and-whisker plots. (DOK 2)	The CCSS focuses on displaying data, while the MMFR objective is at a DOK 2 level.
6.SP.5. Summarize numerical data sets in relation to their	6.5.b. Determine how changes in data affect mean,	The CCSS is explicit in how numerical data is to be summarized

Common Core State Standards for Mathematics	*2007 MS Mathematics Framework Revised*	Comments
context, such as by: a. Reporting the number of observations. b. Describing the nature of the attribute under investigation, including how it was measured and its units of measurement. c. Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered. d. Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered.	median, mode, and range. (DOK 2)	in a series of steps, while the scope of the MMFR is broader.
	6.1.b. Use estimation strategies to determine the reasonableness of results in a variety of situations including rational number computations. (DOK 2)	In the draft of CCSS, there was a standard that included checking for reasonableness.
	6.1.f. Explain the relationship(s) among fractions, decimals, and percents and model and represent a specific quantity in multiple ways. (DOK 2)	Exploring the relationship among the equivalent expressions of rational numbers is included in the grade 7 CCSS.
	6.2.b. Complete a function table based on a given rule. (DOK 2)	Functions are included in the 8th grade CCSR.
	6.2.e. Describe a rule for a function table using words, symbols, and points on a graph	

Common Core State Standards for Mathematics	*2007 MS Mathematics Framework Revised*	Comments
	and vice versa. (DOK 2)	
	6.3.a. Compare, classify, and construct transformations (reflections, translations, and rotations). (DOK 3) 6.3.b. Construct three-dimensional figures using manipulatives and generalize the relationships among vertices, faces, and edges (such as Euler's Formula). (DOK 3)	The CCSS includes most of the other ideas in geometry in the lower grades, i.e., a 5th grade standard is about classifying two-dimensional figures in a hierarchy based on properties. Transformations are included in the CCSS at the 8th grade level.
	6.3.d. Identify, estimate, and compare right, acute, and obtuse angles. (DOK 1)	
	6.3.e. Explain the relationships between corresponding parts of the pre-image and image of a dilation. (DOK 2)	
	6.4.c. Determine the radius, diameter, and circumference of a circle. (DOK 1)	
	6.4.g. Explain the relationship of circumference of a circle to its diameter, linking to *pi*. (DOK 1)	
	6.5.c. Predict trends based on graphical representation. (DOK 3)	This MMFR objective takes graphical representation to a higher level, as noted by DOK 3.

COMMON CORE STATE STANDARDS (CCSS) FOR MATHEMATICS
2007 MISSISSIPPI MATHEMATICS FRAMEWORK REVISED (MMFR)
ALIGNMENT ANALYSIS
Grade 7

CCSS Key:
Ratios and Proportional Relations (RP)
The Number System (NS)
Expressions and Equations (EE)
Geometry (G)
Statistics and Probability (SP)

MMFR Content Standards Key:
Numbers and Operations (1)
Algebra (2)
Geometry (3)
Measurement (4)
Data Analysis and Probability (5)
Depth of Knowledge (DOK)

Common Core State Standards for Mathematics	*2007 MS Mathematics Framework Revised*	Comments
7.RP.1. Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units. *For example, if a person walks 1/2 mile in each 1/4 hour, compute the unit rate as the complex fraction* $^{1/2}/_{1/4}$ *miles per hour, equivalently 2 miles per hour.*	7.1.g. Solve real-life problems involving unit price, unit rate, sales price, sales tax, discount, simple interest, commission, and rates of commission. (DOK 1) 7.4.d. Solve problems involving scale factors using ratios and proportions. (DOK 2)	The MMFR Number and Operations (1) indicates that in the applications of rational numbers and performing basic operations, the concepts of ratio and proportion are to be emphasized. The objectives that follow in that competency are more about the rational numbers than about ratio and proportionality with the exception of 1.g. that includes working with unit rate and rates of commission. Objective 4.d. comes from the measurement strand.
7.RP.2. Recognize and represent proportional relationships between quantities. a. Decide whether two quantities are in a	7.5.a. Use proportions, estimates, and percentages to construct, interpret, and make predictions about a population based on histograms or circle graph representations of data from a	CCSS 7.RP.2 provides guidance on recognizing and representing proportional relationships between quantities in a coordinate plane, in equations, and in real-world contexts.

Common Core State Standards for Mathematics	*2007 MS Mathematics Framework Revised*	Comments
proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin. b. Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships. c. Represent proportional relationships by equations. *For example, if total cost t is proportional to the number n of items purchased at a constant price p, the relationship between the total cost and the number of items can be expressed as t = pn*. d. Explain what a point *(x, y)* on the graph of a proportional relationship means in terms of the situation, with special attention to the points (0, 0) and (1, *r)* where *r* is the unit rate.	sample. (DOK 2)	The similarity here between the MMFR and the CCSS is using data represented in histograms and circle graphs. The intent of the CCSS, however, is to identify the constant of proportionality. The MMFR 5.a. is better matched under the CCSS 7.SP.2. The CCSS 7.RP.2.c focuses on representing proportional relationships by equations, while 7.RP.2.d draws attention to graphing a proportional relationship and highlights points (0, 0) and (1, *r*) where *r* is the unit rate.
7.RP.3. Use proportional relationships to solve multistep ratio and percent problems. *Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error.*	7.1.g. Solve real-life problems involving unit price, unit rate, sales price, sales tax, discount, simple interest, commission, and rates of commission. (DOK 1)	While the emphasis in the competency of the MMFR Number and Operations includes applying ratio and proportion, it is not explicit on how the objectives do that. On the other hand, the CCSS in the domain of Ratio and Proportionality is more explicit on creating deeper understanding of the mathematical ideas of ratio and proportion.
7.NS.1. Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a horizontal or vertical number line diagram. a. Describe situations in which opposite quantities	7.1.b. Solve problems involving addition, subtraction, multiplication, and division of rational numbers. Express answers in simplest form. (DOK 2)	The MMFR includes all operations, while the CCSS focuses on addition and subtraction of rational numbers. CCSS 7.NS.2 focuses on multiplication and division of rational numbers.

Common Core State Standards for Mathematics	*2007 MS Mathematics Framework Revised*	Comments
combine to make 0. *For example, a hydrogen atom has 0 charge because its two constituents are oppositely charged.*		
b. Understand $p + q$ as the number located a distance $\lvert q \rvert$ from p, in the positive or negative direction depending on whether q is positive or negative. Show that a number and its opposite have a sum of 0 (are additive inverses). Interpret sums of rational numbers by describing real-world contexts.	7.1.h. Solve contextual problems requiring the comparison, ordering, and application of integers. (DOK 2)	The implementation of this MMFR may include using the additive inverse and understanding distance between $p + q$, but the objective does not state that and just speaks of integers. The CCSS defines sums of rational numbers.
c. Understand subtraction of rational numbers as adding the additive inverse, $p – q = p + (–q)$. Show that the distance between two rational numbers on the number line is the absolute value of their difference, and apply this principle in real-world contexts.	7.1.h. Solve contextual problems requiring the comparison, ordering, and application of integers. (DOK 2)	This CCSS defines subtraction of rational numbers. The MMFR includes exponents and grouping symbols, which are not explicit in the CCSS.
d. Apply properties of operations as strategies to add and subtract rational numbers.	7.1.a. Use the order of operations to simplify and/or evaluate whole numbers (including exponents and grouping symbols). (DOK 1)	
7.NS.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 or multiplying signed numbers. Interpret products of rational numbers by describing real-world contexts.	7.1.b. Solve problems involving addition, subtraction, multiplication, and division of rational numbers. Express answers in simplest form. (DOK 2) 7.2.e. Identify the following properties using variables and apply them in solving problems: (DOK 1) • Zero property of multiplication • Inverse properties of addition/subtraction and multiplication/division • Commutative and associative properties of addition and multiplication • Identity properties of addition and	As noted in 7.NS.1, this CCSS focuses on multiplication and division of rational numbers only. Fractions as used by the CCSS are the positive rational numbers.

Common Core State Standards for Mathematics	*2007 MS Mathematics Framework Revised*	Comments
	multiplication • Distributive properties of multiplication over addition and subtraction.	
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.		Division by zero is not explicit in the MMFR in the previous, current, or following grade levels.
c. Apply properties of operations as strategies to multiply and divide rational numbers.	7.1.a. Use the order of operations to simplify and/or evaluate whole numbers (including exponents and grouping symbols). (DOK 1)	The difference between the MMFR and CCSS is in the set of numbers to be considered.
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.	7.1.c. Convert among decimals, fractions, mixed numbers, and percents. (DOK 1)	The CCSS focuses on the possible outcomes of converting a rational number to a decimal.
7.NS.3. Solve real-world and mathematical problems involving the four operations with rational numbers.[1]	7.1.b. Solve problems involving addition, subtraction, multiplication, and division of rational numbers. Express answers in simplest form. (DOK 2)	The difference in the MMFR and the CCSS is that the CCSS includes real-world and mathematics problems, while the wording of the MMFR may narrow the objective to simply mathematical problems.
7.EE.1. Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.	7.2.e. Identify the following properties using variables and apply them in solving problems: (DOK 1) • Zero property of multiplication • Inverse properties of addition/subtraction and multiplication/division • Commutative and associative properties of addition and multiplication	The MMFR defines the properties to be used in solving problems. The CCSS has a separate attachment and lists the properties of operations.

[1]Computations with rational numbers extend the rules for manipulating fractions to complex fractions.

Common Core State Standards for Mathematics	***2007 MS Mathematics Framework Revised***	**Comments**
	□ Identity properties of addition and multiplication □ Distributive properties of multiplication over addition and subtraction.	
7.EE.2. Understand that rewriting an expression in different forms in a problem context can shed light on the problem and how the quantities in it are related. *For example, a + 0.05a = 1.05a means that "increase by 5%" is the same as "multiply by 1.05."*	7.2.c. Formulate algebraic expressions, equations, and inequalities to reflect a given situation and vice versa. (DOK 2)	The CCSS provides an example of rewriting an expression, focusing on the relationship of the quantities.
7.EE.3. Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. *For example: if a woman making $25 an hour gets a 10% raise; she will make an additional 1/10 of her salary an hour, or $2.50, for a new salary of $27.50. If you want to place a towel bar 9 3/4 inches long in the center of a door that is 27 1/2 inches wide, you will need to place the bar about 9 inches from each edge; this estimate can be used as a check on the exact computation.*	7.2.b. Solve equations that represent algebraic and real-world problems using multiple methods including the real number properties. (DOK 1) 7.1.c. Convert among decimals, fractions, mixed numbers, and percents. (DOK 1) 7.2.e. Identify the following properties using variables and apply them in solving problems: (DOK 1) • Zero property of multiplication • Inverse properties of addition/subtraction and multiplication/division • Commutative and associative properties of addition and multiplication • Identity properties of addition and multiplication • Distributive properties of multiplication over addition and subtraction.	The multiple methods to be used in the MMFR probably include checking for reasonableness, made explicit in grade 6.
7.EE.4. Use variables to represent quantities in a real-world or mathematical problem, and construct simple	7.2.b. Solve equations that represent algebraic and real-world problems using multiple methods	The pattern that appears in this analysis also is evidenced here, where the MMFR objective is

Common Core State Standards for Mathematics	***2007 MS Mathematics Framework Revised***	**Comments**
equations and inequalities to solve problems by reasoning about the quantities. a. Solve word problems leading to equations of the form $px + q = r$ and $p(x + q) = r$, where p, q, and r are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach. *For example, the perimeter of a rectangle is 54 cm. Its length is 6 cm. What is its width?* b. Solve word problems leading to inequalities of the form $px + q > r$ or $px + q < r$, where p, q, and r are specific rational numbers. Graph the solution set of the 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.*	including the real number properties. (DOK 1)	comprehensive in one statement. The CCSS elaborates on enhancing understanding and provides guidance by giving examples.
7.G.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.	7.4.d. Solve problems involving scale factors using ratios and proportions. (DOK 2)	This MMFR objective is under the measurement strand.
7.G.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.	7.3.f. Construct and classify angles. (DOK 2)	The focus of the CCSS goes beyond constructing and classifying angles, but constructing and classifying angles are inherent in constructing angles with three measures of angles.

Common Core State Standards for Mathematics	***2007 MS Mathematics Framework Revised***	**Comments**
7.G.3. Describe the two-dimensional figures that result from slicing three-dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids.		Plane sections are not addressed in the MMFR in previous or later grade levels.
7.G.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.	7.4.b. Use formulas and strategies, such as decomposition, to compute the perimeter and area of triangles, parallelograms, trapezoids, the circumference and area of circles, and find the area of more complex shapes. (DOK 2)	The MMFR objective is more comprehensive in including other geometric shapes, while the CCSS focus is on circles.
7.G.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.	7.3.f. Construct and classify angles. (DOK 2)	To classify angles implies knowing facts about them, but the CCSS goes beyond knowing how to construct and classify angles.
7.G.6. Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.	7.4.c. Develop and justify geometric formulas for volume and surface area of cylinders, pyramids, and prisms. (DOK 3)	The focus of the CCSS is real-world and mathematical problems, while the MMFR is about formulas at a DOK 3 level.
7.SP.1. Understand that statistics can be used to gain information about a population by examining a sample of the population; generalizations about a population from a sample are valid only if the sample is representative of that population. Understand that random sampling tends to produce representative samples and support valid inferences.	7.5.a. Use proportions, estimates, and percentages to construct, interpret, and make predictions about a population based on histograms or circle graph representations of data from a sample. (DOK 2)	The difference between the MMFR objective and the CCSS is “using” versus “understanding.”
7.SP.2. Use data from a random sample to draw inferences about a population with an unknown characteristic of	7.5.a. Use proportions, estimates, and percentages to construct, interpret, and make predictions	It is not clear if the MMFR objective includes the generating of multiple samples.

Common Core State Standards for Mathematics	*2007 MS Mathematics Framework Revised*	Comments
interest. Generate multiple samples (or simulated samples) of the same size to gauge the variation in.estimates or predictions. *For example, estimate the mean word length in a book by randomly sampling words from the book; predict the winner of a school election based on randomly sampled survey data. Gauge how far-off the estimate or prediction might be.*	about a population based on histograms or circle graph representations of data from a sample. (DOK 2)	
7.SP.3. Informally assess the degree of visual overlap of two numerical data distributions with similar variabilities, measuring the difference between the centers by expressing it as a multiple of a measure of variability. *For example, the mean height of players on the 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.*		There is no MMFR objective in the previous or the following grade levels that explicitly addresses visual overlap.
7.SP.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.*	7.5.b. Determine how outliers affect mean, median, mode, or range. (DOK 2) 7.5.c. Construct and interpret line graphs, frequency tables, circle graphs, box-and-whisker plots, and scatter plots to generalize trends from given data. (DOK 2)	The MMFR 7.5.b objective focuses attention on outliers affecting measures of center. While the CCSS may imply the use of outliers, it is not made explicit in the standard. The MMFR 7.5.c objective involves the use of data to generalize trends.
7.SP.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,	7.5.d. Determine probabilities through experimentation, simulation, or calculation. (Note: Make and test conjectures and predictions by calculating the probability of an event.) (DOK 2)	The CCSS provides guidance on how to gauge the likelihood of an event, while the MMFR objective includes methods of determining probabilities.

Common Core State Standards for Mathematics	*2007 MS Mathematics Framework Revised*	Comments
and a probability near 1 indicates a likely event.		
7.SP.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.*		This CCSS addresses relative frequency, a term not found in the MMFR objectives. There are frequency tables in grade 4, frequency plots in grade 6 and frequency distributions in geometry at the high school level.
7.SP.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?*		Probability models are not found in the MMFR objectives until samples spaces in the Statistics and Probability course in high school.
7.SP.8. Find probabilities of compound events using		Compound events are not included in the MMFR objectives until high

Common Core State Standards for Mathematics	***2007 MS Mathematics Framework Revised***	**Comments**
organized lists, tables, tree diagrams, and simulation. a. Understand that, just as with simple events, the probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs. b. Represent sample spaces for compound events using methods such as organized lists, tables and tree diagrams. For an event described in everyday language (e.g., "rolling double sixes"), identify the outcomes in the sample 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 four donors to find one with type A blood?*		school in the statistics course.
	7.1.d. Evaluate and estimate powers and square roots of real numbers. (DOK 2)	The CCSS begins exponents in grade 5 and square roots in grade 8.
	7.1.e. Explain the relationship between standard form and scientific notation. (DOK 1) 7.1.f. Multiply and divide numbers written in scientific notation. (DOK 1)	Scientific notation is part of the grade 8 CCSS.
	7.1.i. Develop a logical argument to demonstrate the "denseness" of rational numbers. (DOK 3)	Denseness of rational numbers is not included in the CCSS.

Common Core State Standards for Mathematics	*2007 MS Mathematics Framework Revised*	Comments
	7.2.a. Recognize, describe, and state the rule of generalized numerical and geometric patterns using tables, graphs, words, and symbols. (DOK 2)	Generalizing numerical patterns begins in grade 3 and continues to grade 6 in the CCSS.
	7.2.d. Complete a function table based on a given rule and vice versa. (DOK 1) 7.2.f. Predict the shape of a graph from a function table. (DOK 2)	The CCSS begins the use of variables in mathematical expressions with students looking at tables of quantities to describe the relationship between the quantities in grade six. The word function is not used until grade 8 in the CCSS.
	7.3.a. Classify and compare three-dimensional shapes using their properties. (DOK 1) 7.3.b. Construct two-dimensional representations of three-dimensional objects. (DOK 2)	While the CCSS addresses volume as an attribute for solid figures in grade 5, focuses on nets of three-dimensional figures in grade 6 and plane sections in grade 7, classifying, comparing and constructing three-dimensional figures are not included in the CCSS in these grade levels.
	7.3.c. Justify the congruency or symmetry of two figures. (DOK 2)	Laying a foundation for symmetry begins in grade 1 of the CCSS with symmetry being a focus in grade 4. The concept of congruent figures is developed in grade 8.
	7.3.d. Perform transformations (rigid and non-rigid motions) on two-dimensional figures using the coordinate plane. (DOK 2)	Transformations are a focus of high school geometry in the CCSS.
	7.3.e. Create an argument using the Pythagorean Theorem principles to show that a triangle is a	Understanding and applying the Pythagorean Theorem is a cluster in the CCSS grade 8.

Common Core State Standards for Mathematics	***2007 MS Mathematics Framework Revised***	**Comments**
	right triangle. (DOK 2)	
	7.4.a. Convert from one unit to another, perform basic operations, and solve real-world problems using standard (English and metric) measurements within the same system. (DOK 2)	Solving problems involving measurement and conversion of measurements from a larger unit to a smaller unit is a cluster of the CCSS for grade 4.

COMMON CORE STATE STANDARDS (CCSS) FOR MATHEMATICS
2007 MISSISSIPPI MATHEMATICS FRAMEWORK REVISED (MMFR)
ALIGNMENT ANALYSIS
Grade 8 Pre-Algebra (PA)

<u>CCSS Key:</u>
The Number System (NS)
Expressions and Equations (EE)
Functions (F)
Geometry (G)
Statistics and Probability (SP)

<u>MMFR Content Standards Key:</u>
Numbers and Operations (1)
Algebra (2)
Geometry (3)
Measurement (4)
Data Analysis and Probability (5)
Depth of Knowledge (DOK)

Common Core State Standards for Mathematics	*2007 MS Mathematics Framework Revised*	Comments
8.NS.1. Understand informally that every number has a decimal expansion; the rational numbers are those with decimal expansions that terminate in 0s or eventually repeat. Know that other numbers are called irrational. 8.NS.2. Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., π^2). *For example, by truncating the decimal expansion of √2, show that √2 is between 1 and 2, then between 1.4 and 1.5, and explain how to continue on to get better approximations.*	PA.1.a. Define, classify, and order rational and irrational numbers and their subsets. (DOK 1)	The CCSS provides guidance to understanding rational numbers as having a decimal expansion and explaining how to locate irrational numbers. The MMFR objective is concise and more comprehensive.
8.EE.1. Know and apply the properties of integer exponents to generate equivalent numerical expressions. *For example,* $3^2 \times 3^{-5} = 3^{-3} = 1/3^3 = 1/27$.	PA.1.e. Explain the rules of exponents related to multiplication and division of terms with exponents. (DOK 2)	The CCSS narrows the standard to integer exponents.

Common Core State Standards for Mathematics	***2007 MS Mathematics Framework Revised***	**Comments**
8.EE.2. Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where *p* is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that $\sqrt{2}$ is irrational.	PA.1.g. Explain and use the inverse relationship between square roots and squares. (DOK 2)	The MMFR objective addresses explaining and using the inverse relationship between square roots and squares, which is not included in the CCSS. The CCSS connects square roots and cube root symbols as solutions to equations.
8.EE.3. Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other. *For example, estimate the population of the United States as* 3×10^8 *and the population of the world as* 7×10^9*, and determine that the world population is more than 20 times larger.* 8.EE.4. Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology.	PA.1.f. Recognize and appropriately use exponential and scientific notation. (DOK 1)	Scientific notation is first encountered in grade seven in the MMFR objectives. Scientific notation, however, is first encountered in grade eight in the CCSS.
8.EE.5. Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. *For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.*	PA.2.e. Graph linear equations and non-linear equations ($y = x^2$) using multiple methods including t-tables and slope-intercept. (DOK 2)	The MMFR objective includes multiple methods that could include the comparison of proportional relationships, but the objective is not that explicit.

Common Core State Standards for Mathematics	***2007 MS Mathematics Framework Revised***	**Comments**
8.EE.6. Use similar triangles to explain why the slope *m* is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation *y* = *mx* for a line through the origin and the equation *y* = *mx* + *b* for a line intercepting the vertical axis at *b*.		While slope-intercept is used as a method to solve linear and non-linear equations, it is unclear whether the MMFR objective 2.e includes the method of using similar triangles.
8.EE.7. Solve linear equations in one variable. a. Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form *x* = *a*, *a* = *a*, or *a* = *b* results (where *a* and *b* are different numbers). b. Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.	PA.2.a. Simplify and evaluate numerical and algebraic expressions. (DOK 1) PA.2.c. Solve and check equations and inequalities using one variable. (DOK 2)	Solving and checking equations and inequalities using one variable, MMFR PA.2.c., includes simplifying and evaluating numerical and algebraic expressions, MMFR PA..2.a. The CCSS is clear in its intent to develop conceptual understanding about solving equations in one variable.
8.EE.8. Analyze and solve pairs of simultaneous linear equations. a. Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously. b. Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection. *For example, 3x + 2y = 5 and 3x +2y = 6*		Pairs of simultaneous linear equations are not addressed at this grade level in the MMFR objectives. These are included in Algebra I of the MMFR.

Common Core State Standards for Mathematics	***2007 MS Mathematics Framework Revised***	**Comments**
have no solution because 3x + 2y cannot simultaneously be 5 and 6. c. Solve real-world and mathematical problems leading to two linear equations in two variables. *For example, given coordinates for two pairs of points, determine whether the line through the first pair of points intersects the line through the second pair.*		
8.F.1. Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.[1]	PA.2.i. Predict characteristics of a graph given an equation or t-table. (DOK 2)	The MMFR objective appears more rigorous than the CCSS.
8.F.2. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.*	PA.2.g. Determine slope, x-intercept, and y-intercept from a graph and/or equation in slope-intercept or standard form. (DOK 1)	While both the MMFR objective and the CCSS have similarity in the concepts used, the CCSS is asking for comparison between two functions.
8.F.3. Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. *For example, the function* $A = s^2$ *giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1), (2,4) and (3,9), which are not on a straight line.*	PA.2.e. Graph linear equations and non-linear equations ($y = x^2$) using multiple methods including t-tables and slope-intercept. (DOK 2)	The MMFR objective is more comprehensive in the graphing of linear and non-linear equations, while the CCSS provides an example to describe a possible solution.

[1] Function notation is not required in Grade 8.

Common Core State Standards for Mathematics	***2007 MS Mathematics Framework Revised***	**Comments**
8.F.4. Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (*x*, *y*) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.	PA.2.f. Given a linear graph, identify its slope as positive, negative, undefined, or zero, and interpret slope as rate of change. (DOK 2)	The CCSS prompts students to think of a function as a model of a linear relationship between two quantities, while the MMFR objective focuses on identifying attributes of a slope.
8.F.5. Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.	PA.2.i. Predict characteristics of a graph given an equation or t-table. (DOK 2)	The CCSS calls for describing the functional relationship, while the MMFR objective calls for predicting.
8.G.1. Verify experimentally the properties of rotations, reflections, and translations: a. Lines are taken to lines, and line segments to line segments of the same length. b. Angles are taken to angles of the same measure. c. Parallel lines are taken to parallel lines.		Transformational Geometry is introduced at grade 4 in the MMFR.
8.G.2. Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them.		While a geometry MMFR objective in grade 7 speaks of congruency, congruency is not addressed in relation to transformations.

Common Core State Standards for Mathematics	***2007 MS Mathematics Framework Revised***	**Comments**
8.G.3. Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates. 8.G.4. Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.		While transformations are introduced in fourth grade in the MMFR, it is not to the rigor level of these in the CCSS.
8.G.5. Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles. *For example, arrange three copies of the same triangle so that the sum of the three angles appears to form a line, and give an argument in terms of transversals why this is so.*	PA.3.a. Locate and identify angles formed by parallel lines cut by a transversal(s) (e.g., adjacent, vertical, complementary, supplementary, corresponding, alternate interior, and alternate exterior). (DOK 1) PA.3.b. Find missing angle measurements for parallel lines cut by a transversal(s) and for a vertex of a polygon. (DOK 1)	The CCSS includes three sets of angle formations, while the MMFR objectives focus on angles formed by parallel lines cut by a transversal.
8.G.6. Explain a proof of the Pythagorean Theorem and its converse. 8.G.7. Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.	PA.3.c. Explain the Pythagorean Theorem and apply it to solve routine and non-routine problems. (DOK 3)	The MMFR objective includes non-routine problems, and the CCSS includes the converse of the Pythagorean Theorem.

Common Core State Standards for Mathematics	***2007 MS Mathematics Framework Revised***	**Comments**
8.G.8. Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.		The application of the Pythagorean Theorem to find the distance between two points in a coordinate system is not explicit in the MMFR until Algebra I.
8.G.9. Know the formulas for the volumes of cones, cylinders, and spheres, and use them to solve real-world and mathematical problems.	PA.4.c. Use formulas and/or appropriate measuring tools to find length and angle measures (to appropriate levels of precision), perimeter, area, volume, and surface area of polygons, circles, spheres, cones, pyramids, and composite or irregular figures. (DOK 1)	The MMFR objective clearly specifies the use of appropriate measuring tools.
8.SP.1. Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.	PA.5.d. Construct and interpret scatter plots to generalize trends from given data sets. (DOK 3)	The CCSS is more specific about specific patterns to use when constructing and using scatter plots for bivariate measurement data.
8.SP.2. Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line.		While the term is not included here, this is introduction to linear regression in the CCSS, which is included in Algebra I in the MMFR.
8.SP.3. Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. *For example, in a linear model for a biology experiment, interpret a slope of 1.5 cm/hr as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height.*	PA.2.i. Predict characteristics of a graph given an equation or t-table. (DOK 2)	Examples in the CCSS provide guidance to draw attention to the concepts involved.

Common Core State Standards for Mathematics	*2007 MS Mathematics Framework Revised*	Comments
8.SP.4. Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables. *For example, collect data from students in your class on whether or not they have a curfew on school nights and whether or not they have assigned chores at home. Is there evidence that those who have a curfew also tend to have chores?*	PA.5.d. Construct and interpret scatter plots to generalize trends from given data sets. (DOK 3)	The CCSS is more explicit on how the data are to be displayed and interpreted.
	PA.1.b. Formulate and solve standard and real-life problems involving addition, subtraction, multiplication, and division of rational numbers. (DOK 2)	Rational numbers are included in the sixth grade CCSS.
	PA.1.c. Apply the concepts of Greatest Common Factor (GCF) and Least Common Multiple (LCM) to monomials with variables. (DOK 2)	GCF and LCM are included in the sixth grade CCSS.
	PA.1.d. Simplify and evaluate expressions using order of operations and use real number properties to justify solutions. (DOK 2)	Order of operations is first introduced in the third grade CCSS as well as fractions *a/b* where *a* is a positive whole number and *b* is a positive whole number (non-negative number).
	PA.2.b. Apply properties of real numbers with an emphasis on the distributive properties of multiplication over addition and subtraction. (DOK 1)	The distributive property is introduced in third grade and includes fractions in the sixth grade CCSS.

Common Core State Standards for Mathematics	*2007 MS Mathematics Framework Revised*	Comments
	PA.2.d. Model inequalities (and their solutions) on a number line. (DOK 1)	Inequalities and their solutions are included in the sixth grade CCSS.
	PA.2.h. Add, subtract, and multiply monomials and binomials. (DOK 1)	Applying the properties to generate equivalent expressions is included in the sixth grade CCSS.
	PA.3.d. Solve real-world and non-routine problems involving congruent and similar figures. (DOK 3)	While congruency and similar figures are included at this grade level in the CCSS, it is not at the same context as this MMFR objective. Congruency in the CCSS is connected to transformations.
	PA.3.e. Use two-dimensional representations (nets) of three-dimensional objects to describe objects from various perspectives. (DOK 2)	Nets are included in the sixth grade CCSS.
	PA.4.a. Solve real-world application problems that include length, area, perimeter, and circumference using standard measurements. (DOK 2)	Standard measurement is introduced in the fourth grade CCSS.
	PA.4.b. Develop, analyze, and explain methods for solving problems involving proportions, such as scaling and finding equivalent ratios. (DOK 3)	This is included in the sixth grade CCSS.

Common Core State Standards for Mathematics	*2007 MS Mathematics Framework Revised*	Comments
	PA.5.a. Use a given mean, mode, median, and range to summarize and compare data sets including investigation of the different effects that change in data values have on these measures. (DOK 2) PA.5.b. Select the appropriate measures of central tendency for a particular purpose. (DOK 2)	These are included in the sixth grade CCSS.
	PA.5.c. Make and list conjectures by calculating probability for experimental or simulated contexts. (DOK 3)	This is included in the sixth grade CCSS.

COMMON CORE STATE STANDARDS (CCSS) FOR MATHEMATICS
2007 MISSISSIPPI MATHEMATICS FRAMEWORK REVISED (MMFR)
ALIGNMENT ANALYSIS
Algebra I (AI)

CCSS Key:
Seeing the Structure of Expressions (SSE)
Arithmetic with Polynomials and Rational Functions (APR)
Creating Equations (CED)
Reasoning with Equations and Inequalities (REI)
□ Modeling Standards
(+) Standards that Include Complex Numbers on Complex Plane In Rectangular and Polar Form (Includes Real and Imaginary Numbers)

MMFR Content Standards Key:
Numbers and Operations (1)
Algebra (2)
Geometry (3)
Measurement (4)
Data Analysis and Probability (5)
Depth of Knowledge (DOK)

Common Core State Standards for Mathematics	***2007 MS Mathematics Framework Revised***	**Comments**
A-SSE.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* $P(1+r)^n$ *as the product of P and a factor not depending on P.*	AI.2.a. Solve, check, and graph multi-step linear equations and inequalities in one variable, including rational coefficients in mathematical and real-world situations. (DOK 2)	Interpreting an expression involves analysis of its underlying structure in this CCSS. While this skill is inherent in the MMFR objective 2.a., there is no MMFR objective focusing on interpreting expressions.
A-SSE.2. Use the structure of an expression to identify ways to rewrite it. *For example, see* $x^4 - y^4$ *as* $(x2)^2 - (y2)^2$, *thus recognizing it as a difference of squares that can be factored as* $(x^2 - y^2)(x^2 + y^2)$.	AI.2.h. Factor polynomials by using Greatest Common Factor (GCF) and factor quadratics that have only rational roots. (DOK 1)	The MMFR objective involves factoring, but it is not explicit in whether the objective is addressing the difference of squares.

Common Core State Standards for Mathematics	*2007 MS Mathematics Framework Revised*	Comments
A-SSE.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* 1.15^t *can be rewritten as* $(1.15^{1/12})^{12t} \approx 1.012^{12t}$ *to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.*	AI.2.i. Determine the solutions to quadratic equations by using graphing, tables, completing the square, the Quadratic formula, and factoring. (DOK 1)	Equivalent forms of an expression begin at third grade in the MMFR but do not necessarily call for revealing and explaining the properties of the quantity represented by the expression. Zeros of functions are included in the Algebra II and the Pre-Calculus curriculum in the MMFR. Solving systems of quadratic equations using a variety of methods is in the Algebra II MMFR. Exponential functions related to growth and decay are in the MMFR Algebra II objectives.
A-SSE.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. *For example, calculate mortgage payments.*		Evaluating and applying infinite geometric series is an objective in both the Algebra II and Pre-Calculus MMFR.
A-APR.1. Understand that polynomials form a system analogous to the integers; namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.	AI.2.g. Add, subtract, multiply, and divide polynomial expressions. (DOK 1) AI.1.a. Apply properties of real numbers to simplify algebraic expressions, including polynomials. (DOK 1)	Understanding that polynomials form a system may be inherent when adding, subtracting, multiplying and dividing polynomial expressions, but that is not made explicit in the MMFR objective.
A-APR.2. Know and apply the Remainder Theorem: For a		The Remainder Theorem is not in the MMFR as labeled.

Common Core State Standards for Mathematics	***2007 MS Mathematics Framework Revised***	**Comments**
polynomial *p*(*x*) and a number *a*, the remainder on division by $x – a$ is *p*(*a*), so *p*(*a*) = 0 if and only if ($x – a$) is a factor of *p*(*x*).		
A-APR.3. Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.		Finding the zeros of polynomial functions by synthetic division and by the Factor Theorem is an MMFR objective in Precalculus.
A-APR.4. Prove polynomial identities and use them to describe numerical relationships. *For example, the polynomial identity* $(x^2 + y^2)^2 = (x^2 – y^2)^2 + (2xy)^2$ *can be used to generate Pythagorean triples.*		There is no MMFR objective focusing on polynomial identities. There is an MMFR objective in Algebra II that includes sums and differences of cubes.
A-APR.5. (+) Know and apply the Binomial Theorem for the expansion of $(x + y)^n$ in powers of *x* and *y* for a positive integer *n*, where *x* and *y* are any numbers, with coefficients determined for example by Pascal's Triangle.[1]		Explaining the Binomial Theorem is an MMFR objective in Algebra II, while the relationship between Pascal's Triangle and the Binomial Theorem is an MMFR objective in Advanced Algebra.
A.APR.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.		Synthetic division is included in an MMFR objective in Precalculus.
A-APR.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.	AI.1.a. Apply properties of real numbers to simplify algebraic expressions, including polynomials. (DOK 1)	Understanding that rational numbers form a system may be inherent when adding, subtracting, multiplying and dividing rational numbers, but that is not made explicit in the MMFR objective.

[1]The Binomial Theorem can be proved by mathematical induction or by a combinatorial argument.

Common Core State Standards for Mathematics	*2007 MS Mathematics Framework Revised*	Comments
A-CED.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 and exponential functions.* A-CED.2. (+) Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. A-CED.3. (+) Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.*	AI.2.a. Solve, check, and graph multi-step linear equations and inequalities in one variable, including rational coefficients in mathematical and real-world situations. (DOK 2) AI.2.f. Use algebraic and graphical methods to solve systems of linear equations and inequalities in mathematical and real-world situations. (DOK 2)	The MMFR objectives do not call for creating equations.
A-CED.4. (+) Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law V =IR to highlight resistance R.*		In the MMFR, applying algebraic equations and functions to engineering situations is found in the Introduction to Engineering course at the high school level.
A-REI.1. Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.		In the Algebra Content Strand of the MMFR objectives for sixth grade, students are explaining and using algebraic functions, patterns, and language across different contexts, but the objective does not directly focus on assumptions that drive solving a simple equation.

Common Core State Standards for Mathematics	*2007 MS Mathematics Framework Revised*	Comments
A-REI.2. Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise. A-REI.3. Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.	AI.2.a. Solve, check, and graph multi-step linear equations and inequalities in one variable, including rational coefficients in mathematical and real-world situations. (DOK 2) AI.2.f. Use algebraic and graphical methods to solve systems of linear equations and inequalities in mathematical and real-world situations. (DOK 2)	Giving examples of how extraneous solutions may arise or including equations with coefficients represented by letters are not explicitly stated in the MMFR objectives.
A-REI.4. Solve quadratic equations in one variable. a. Use the method of completing the square to transform any quadratic equation in *x* into an equation of the form $(x - p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form. b. Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions, and write them as $a \pm bi$ for real numbers *a* and *b*.	AI.2.i. Determine the solutions to quadratic equations by using graphing, tables, completing the square, the Quadratic formula, and factoring. (DOK 1)	The CCSS connects the method of completing the square to the derivation of the quadratic formula. It also addresses complex solutions.

Common Core State Standards for Mathematics	***2007 MS Mathematics Framework Revised***	**Comments**
A-REI.5. Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions. A-REI.6. Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.	AI.2.f. Use algebraic and graphical methods to solve systems of linear equations and inequalities in mathematical and real-world situations. (DOK 2)	The CCSS provides rigor in A-REI.5 by asking for a proof of a possible method in solving systems of linear equations. The 2.f objective includes inequalities.
A-REI.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 $x^2 + y^2 = 3$.		Solving linear-quadratic and quadratic-quadratic systems of equations and inequalities is an MMFR objective in Advanced Algebra.
A-REI.8. (+) Represent a system of linear equations as a single matrix equation in a vector variable. A-REI.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).	AI.1.b. Use matrices to solve mathematical situations and contextual problems. (DOK 2)	The use of matrices in the MMFR objective is under the Number and Operations strand and may not include systems of linear equations.

Common Core State Standards for Mathematics	*2007 MS Mathematics Framework Revised*	Comments
A-REI.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). A-REI.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 approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where *f*(*x*) and/or *g*(*x*) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.□	AI.2.e. Graph and analyze linear functions. (DOK 2)	The MMFR objectives are more comprehensive in the content, while the CCSS are more explicit in citing possible solutions and understandings.
A-REI.12. Graph the solutions to a linear inequality in two variables as a half plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.	AI.2.l. Write, graph, and analyze inequalities in two variables. (DOK 2)	Inherent in graphing solutions to inequalities is the use of the coordinate plane. The CCSS is explicit on how the solution is to be represented.
	AI.2.b. Solve and graph absolute value equations and inequalities in one variable. (DOK 2)	While absolute value is first introduced in the sixth grade in the CCSS, there is no CCSS that explicitly focuses on solving and graphing absolute value equations and inequalities in one variable.
	AI.2.c. Analyze the relationship between *x* and *y* values, determine whether a relation is a function, and identify domain and range. (DOK 2)	Defining, evaluating, and comparing functions is a CCSS objective in grade eight, and identifying domain of a function is at the high school level under Functions.

Common Core State Standards for Mathematics	*2007 MS Mathematics Framework Revised*	Comments
	AI.2.d. Explain and illustrate how a change in one variable may result in a change in another variable and apply to the relationships between independent and dependent variables. (DOK 2)	The relationship between the independent and dependent variables is introduced at the 6th grade level in the CCSS.
	AI.2.j. Justify why some polynomials are prime over the rational number system. (DOK 2)	This was not found in the CCSS.
	AI.2.k. Graph and analyze absolute value and quadratic functions. (DOK 2)	This MMFW objective is more aligned with objectives in Functions MMFR.
	AI.3.a. Apply the concept of slope to determine if lines in a plane are parallel or perpendicular. (DOK 2) AI.3.b Solve problems that involve interpreting slope as a rate of change. (DOK 2)	Slope is included at the 7th grade in the CCSS.
	AI.4.a. Solve real-world problems involving formulas for perimeter, area, distance, and rate. (DOK 2)	Solving real-world problems involving formulas begins at the 6th grade level in the CCSS.
	AI.4.b. Explain and apply the appropriate formula to determine length, midpoint, and slope of a segment in a coordinate plane (i.e., distance formula, Pythagorean Theorem). (DOK 2)	Using the Pythagorean Theorem to determine distance in a coordinate plane is found at the 8th grade level in the CCSS.
	AI.4.c. Represent polynomial operations with area	Using area models was not explicitly mentioned in the CCSS.

Common Core State Standards for Mathematics	*2007 MS Mathematics Framework Revised*	Comments
	models. (DOK 2)	
	AI.5.a. Draw conclusions and make predictions from scatter plots. (DOK 3)	Using scatter plots is included at the grade eight level in the CCSS.
	AI.5.b. Use linear regression to find the line-of-best fit from a given set of data. (DOK 3)	Linear regression is at the high school level in the CCSS, but informal introduction to judging closeness of data points to a line is introduced at the 8th grade level.

Non-Tested Grade

COMMON CORE STATE STANDARDS (CCSS) FOR MATHEMATICS
2007 MISSISSIPPI MATHEMATICS FRAMEWORK REVISED (MMFR)
ALIGNMENT ANALYSIS
Transitions to Algebra (TA)

CCSS Domain Key:
The Number System (NS)
Expressions and Equations (EE)
Functions (F)
Geometry (G)
Statistics and Probability (SP)

MMFW Content Standard Key:
Numbers and Operations (1)
Algebra (2)
Geometry (3)
Measurement (4)
Data Analysis and Probability (5)
Depth of Knowledge (DOK)

Common Core State Standards for Mathematics	*2007 MS Mathematics Framework Revised*	Comments
8.NS.1. Understand informally that every number has a decimal expansion; the rational numbers are those with decimal expansions that terminate in 0s or eventually repeat. Know that other numbers are called irrational.	TA.1.a. Compare and contrast the subsets of real numbers. (DOK 1)	The CCSS provides guidance to understanding rational numbers as having a decimal expansion and explaining how to locate irrational numbers. The MMFR objective focuses on comparing and contrasting the subsets of real numbers but does not specify how it is to be done or what to look for.
8.NS.2. Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., π^2). *For example, by truncating the decimal expansion of √2, show that √2 is between 1 and 2, then between 1.4 and 1.5, and explain how to continue on to get better approximations.*		
8.EE.1. Know and apply the properties of integer exponents to generate equivalent numerical expressions. *For example,* $3^2 \times 3^{-5} = 3^{-3} = 1/3^3 = 1/27$.		Rules for exponents are included in the Pre-Algebra course in the MMFR.

Common Core State Standards for Mathematics	***2007 MS Mathematics Framework Revised***	**Comments**
8.EE.2. Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that √2 is irrational.	TA.1.e. Use the inverse relationship to develop the concept of roots and perfect squares. (DOK 2)	The MMFR objective addresses using the inverse relationship between square roots and squares, which is not included in or does not appear to be the focus of the CCSS.
8.EE.3. Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities and to express how many times as much one is than the other. *For example, estimate the population of the United States as 3 x 10^8 and the population of the world as 7 x 10^9, and determine that the world population is more than 20 times larger.* 8.EE.4. Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation, and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology.	TA.1.c. Express, interpret, and compute numbers using scientific notation in meaningful contexts. (DOK 1)	Scientific notation is first encountered in the 7th grade in the MMFR. Scientific notation, however, is first encountered in the 8th grade in the CCSS.
8.EE.5. Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. *For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.*	TA.2.d. Use real-world data to express slope as a rate of change. (DOK 2) TA.2.j. Apply ratios and use proportional reasoning to solve real-world algebraic problems. (DOK 2)	The CCSS focuses on the comparison of two different proportional relationships. This could also be inherent in the MMFR objective, but this is not explicitly stated.
8.EE.6. Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the	TA.2.f. Write linear equations given slope and y-intercept or two points. (DOK 2)	The use of similar triangles to explain slope as described in the CCSS does not appear to be the focus of the MMFR 2.f. objective.

Common Core State Standards for Mathematics	*2007 MS Mathematics Framework Revised*	Comments
equation $y = mx$ for a line through the origin and the equation $y = mx + b$ for a line intercepting the vertical axis at b.	TA.3.b. Apply proportional reasoning to determine similar figures and find unknown measures. (DOK 2)	Applying proportional reasoning could be used in explaining slope, but the MMFR 3.b. objective does not specify that.
8.EE.7. Solve linear equations in one variable. a. Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form $x = a$, $a = a$, or $a = b$ results (where a and b are different numbers). b. Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.		Solving linear equations and inequalities are included in Pre-Algebra in the MMFR.
8.EE.8. Analyze and solve pairs of simultaneous linear equations. a. Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously. b. Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection. *For example,* $3x + 2y = 5$ *and* $3x + 2y = 6$ *have no solution because* $3x + 2y$ *cannot simultaneously be 5 and 6.*		Pairs of simultaneous linear equations are addressed in Algebra I in the MMFR.

Common Core State Standards for Mathematics	***2007 MS Mathematics Framework Revised***	**Comments**
c. Solve real-world and mathematical problems leading to two linear equations in two variables. *For example, given coordinates for two pairs of points, determine whether the line through the first pair of points intersects the line through the second pair.*		
8.F.1. Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.[1]	TA.2.I. Analyze the relationship between x and y values to determine whether a relation is a function. (DOK 2)	The CCSS introduces the rule for a function, while the MMFR objective is, perhaps, at the next level, determining if a relationship between two quantities is a function.
8.F.2. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.*		Graphing and analyzing linear functions is an MMFR objective in Algebra I.
8.F.3. Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. *For example, the function* $A = s^2$ *giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1), (2,4) and (3,9), which are not on a straight line.*		The MMFR objective is more comprehensive in the graphing of linear and nonlinear equations, while the CCSS provides an example to describe a possible solution.
8.F.4. Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and	TA.2.h. Develop generalizations to characterize the behaviors of graphs (linear, quadratic, and absolute value). (DOK 2) TA.2.g. Identify domain, range, slope, and intercepts of	The MMFR objective goes beyond linear relationships between two quantities. The CCSS provides guidance on how to interpret the rate of change, etc.

Common Core State Standards for Mathematics	***2007 MS Mathematics Framework Revised***	**Comments**
in terms of its graph or a table of values.	functions. (DOK 1)	

[1]Function notation is not required in Grade 8.

8.F.5. Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.		Classifying functions based on their sketches is included in Algebra II in the MMFR.
8.G.1. Verify experimentally the properties of rotations, reflections, and translations: a. Lines are taken to lines, and line segments to line segments of the same length. b. Angles are taken to angles of the same measure. c. Parallel lines are taken to parallel lines.		The properties of transformations begin at the 4th grade level in the MMFR.

Common Core State Standards for Mathematics	***2007 MS Mathematics Framework Revised***	**Comments**
8.G.2. Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them. 8.G.3. Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates. 8.G.4. Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.		While the properties of transformations begin at the 4th grade level in the MMFR, the effect of transformations of two dimensional figures on a coordinate plane, such as congruency and similarity, is not made explicit in the MMFR, even at the 5th, 6th, or 7th grades.
8.G.5. Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles. *For example, arrange three copies of the same triangle so that the sum of the three angles appears to form a line, and give an argument in terms of transversals why this is so.*		Locating and identifying angles formed by parallel lines cut by a transversal(s) is included in the Pre-Algebra course of the MMFR but does not necessarily call for informal arguments as does the CCSS.
8.G.6. Explain a proof of the Pythagorean Theorem and its converse.		Explaining the Pythagorean Theorem is included in Pre-Algebra in the MMFR, but explaining the converse was not explicitly stated in the MMFR.

Common Core State Standards for Mathematics	***2007 MS Mathematics Framework Revised***	**Comments**
8.G.7. Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.	TA.3.a. Apply the Pythagorean Theorem to solve problems. (DOK 2)	While not explicitly calling for real-world and mathematical problems in two and three dimensions, the MMFR objective could very well mean that.
8.G.8. Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.	TA.4.b. Explain and apply the appropriate formula to determine length, midpoint, and slope of a segment in a coordinate plane (i.e., distance formula, Pythagorean Theorem). (DOK 2)	The MMFR objective goes beyond just using the distance formula.
8.G.9. Know the formulas for the volumes of cones, cylinders, and spheres, and use them to solve real-world and mathematical problems.	TA.4.a. Solve real-world problems involving measurements (i.e., circumference, perimeter, area, volume, distance, temperature, etc.). (DOK 2) TA.2.a. Given a literal equation solve for a specified variable of degree one. (DOK 1)	The CCSS focuses on volume, while the MMFR objectives are more comprehensive.
8.SP.1. Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.		The MMFR objective includes generalizing trends from data displayed in tables and graphs. The CCSS objective focuses on data displayed in scatter plots.
8.SP.2. Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line and informally assess the model fit by judging the closeness of the data points to the line.		While the term of linear regression is not used here, this CCSS introduces linear regression at this grade level. Linear regression is included in Algebra I in the MMFR.

Common Core State Standards for Mathematics	***2007 MS Mathematics Framework Revised***	**Comments**
8.SP.3. Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. *For example, in a linear model for a biology experiment, interpret a slope of 1.5 cm/hr as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height.*		The MMFR objective includes generalizing trends from data displayed in tables and graphs, while the CCSS focuses on linear models. Inherent in this MMFR objective could be interpreting slope.
8.SP.4. Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables. *For example, collect data from students in your class on whether or not they have a curfew on school nights and whether or not they have assigned chores at home. Is there evidence that those who have a curfew also tend to have chores?*	TA.5.a. Construct and interpret line graphs, frequency tables, circle graphs, box-and-whisker plots, and scatter plots to generalize trends from given data. (DOK 2)	The MMFR objective includes generalizing trends from data displayed in tables and graphs. The CCSS objective focuses on two-way tables.
	TA.1.b. Simplify and evaluate expressions using order of operations, and use real-number properties to justify solutions. (DOK 2)	Both the CCSS and the MMFR demonstrate emphasis on the number properties beginning in 1st grade. There is no CCSS at this grade level focusing explicitly on order of operations and real number properties.
	TA.1.d. Apply the concept of Greatest Common Factor (GCF) and Least Common Multiple (LCM) to monomials with variables. (DOK 2)	GCF and LCM are included in the 6th grade CCSS.

Common Core State Standards for Mathematics	*2007 MS Mathematics Framework Revised*	Comments
	TA.2.b. Explain and illustrate how changes in one variable may result in a change in another variable. (DOK 2)	Representing and analyzing quantitative relationships between dependent and independent variables is in the 6th grade CCSS.
	TA.2.c. Solve and check multi-step equations and inequalities, including distributive property, variables on both sides, and rational coefficients. (DOK 2)	Equations and inequalities are at the 6th grade level in the CCSS.
	TA.2.e. Graph solutions to linear inequalities. (DOK 2)	Graphing solutions to inequalities is included in the 6th grade in the CCSS.
	TA.2.i. Classify and determine degree of a polynomial and arrange polynomials in ascending or descending order of a variable. (DOK 1)	Performing arithmetic operations on polynomials is in Algebra in the CCSS.
	TA.2.k. Add, subtract, multiply, and divide polynomial expressions. (DOK 1)	
	TA.5.b. Use a given mean, mode, median, and range to summarize and compare data sets including investigation of the different effects that change in data have on these measures of central tendency, and select the appropriate measures of central tendency for a given purpose. (DOK 2)	The focus at this grade level in the CCSS seems to be working with scatter plots. The measures of central tendency are in 6th grade in the CCSS.
	TA.5.c. Calculate basic probability of experiments and simulations to make and test conjectures about results. (DOK 3)	Both the CCSS and the MMFR address probability in the 7th grade. However, probability is not the focus here for the CCSS.