West Virginia Department of EDUCATION

GLOBAL21
Students deserve it • The world demands it

CROSSWALK

Next Generation Mathematics Content Standards and Objectives for WV Schools

Introduction to the Next Generation West Virginia Content Standards and Objectives Crosswalk to the West Virginia 21st Century Content Standards and Objectives for Mathematics

The Common Core State Standards (CCSS) represent a state-led effort to create shared academic standards that will help ensure all American students are ready for college and work. Teachers representing all grade levels for mathematics came together with staff from Higher Education to review the WV 21st Century Content Standards and Objectives and align them with the Common Core State Standards. This work, resulting in the Next Generation of Mathematics Content Standards and Objectives for West Virginia Schools, was presented to the West Virginia Board of Education in May 2011. The Common Core State Standards Initiative is built on the strong foundation of standards already in place in states across the country. With a goal of *fewer, clearer and higher,* the CCSS were designed to clearly articulate the standards of success in mathematics at each grade level.

A common set of academic standards, shared across states, can help ensure all students, no matter where they live, are prepared for success in college and work. We believe students, parents and teachers working toward a shared goal will result in annual improved student academic performance. Consequently, our students will leave high school better prepared to succeed in their next steps.

The stakeholders, who used the CCSS to create the Next Generation of WV Content Standards and Objectives for Mathematics, prepared this crosswalk between the current 21st Century Content Standards and Objectives for Mathematics in West Virginia Schools and the Next Generation of Mathematics Content Standards and Objectives for WV Schools. This crosswalk document identifies matches between individual objectives within the two sets of standards, addresses any changes in content by grade levels and speaks to the degree of alignment between standards from each document. The intent is to assist users in understanding the movement of content and cross-referencing instructional materials.

How to Read the Crosswalk Document

This West Virginia Crosswalk document is designed to help readers easily understand the similarities and differences between the Next Generation (NxG) WV Content Standards and Objectives for Mathematics, which have been aligned with the *Common Core State Standards for Mathematics,* and the current 21st Century Content Standards and Objectives (CSOs) for Mathematics in WV Schools.

Grade Change (△) Next Generation WV Objective – WV 21st Century Objective.

Positive (+) Grade Change – Content moving to higher grade.

Negative (-) Grade Change – Content moving to lower grade

NxG WV State Objective Aligned to CCSS	WV 21st Century Objective	Grade△	Alignment	
	This objective is the currently adopted objective in WV Public Schools.	**+1 Positive Grade change; Content moving to the next higher grade** **0 No change** **-1 Negative Grade change; Content moving to previous or lower grade**	**Index** **3: Excellent** **2: Partial** **1: Weak** **0: No Match**	**The comment section will provide the reader with specific information relevant to the crosswalk between the standards identified. The intent is to provide the reader specific information relevant to any changes in student expectations.**

Kindergarten Mathematics

How to Read the Crosswalk Document

The West Virginia Crosswalk document is designed to help readers easily understand the similarities and differences between the 21st Century Content Standards and Objectives for English Language Arts and Mathematics in WV Schools and the Next Generation WV Content Standards and Objectives for English Language Arts and Mathematics that have been aligned with the *Common Core State Standards for English Language Arts and Literacy in History/Social Studies, Science and Technical Subjects* and the *Common Core State Standards for Mathematics.*

NxG WV State Objective Aligned to CCSS	WV 21st Century Objective	Grade △	Alignment	Comment
M.K.CC.1 Count to 100 by ones and by tens.	**M.O.K.1.1** count forward to 20 and backward from 10 with and without manipulatives.	**0**	**2**	The NxG WV objective requires counting to 100.
	M.O.K.1.3 group and count manipulatives by ones, fives, and tens.	**0**	**2**	The NxG WV objective focuses on numbers to 100 with variations of number patterns and counting.
	M.O.K.2.3 model and identify patterns of counting by 5's and 10's.	**0**	**1**	The NxG WV objective concentrates on patterns within the counting and cardinality sequence 100.
M.K.CC.2 Count forward beginning from a given number within the known sequence (instead of having to begin at 1).	**M.O.K.1.1** count forward to 20 and backward from 10 with and without manipulatives.	**0**	**2**	The NxG WV objective builds number sense when asking students to count from any given number.
M.K.CC.3 Write numbers from 0 to 20. Represent a number of objects with a written numeral 0-20 (with 0 representing a count of no objects).	**M.O.K.1.1** count forward to 20 and backward from 10 with and without manipulatives.	**0**	**1**	The NxG WV objective connects written numerals with representations to build mathematical understanding.
	M.O.K.1.2 read, write, order, and	**0**	**2**	Writing and representing numbers is

	compare numbers to 20 using multiple strategies (e.g. manipulatives, number line)			emphasized with the NxG WV objective, as well as including the representation of 0.
M.K.CC.4 Understand the relationship between numbers and quantities; connect counting to cardinality. a. When counting objects, say the number names in the standard order, pairing each object with one and only one number name and each number name with one and only one object. b. Understand that the last number name said tells the number of objects counted. The number of objects is the same regardless of their arrangement or the order in which they were counted. **c.** Understand that each successive number name refers to a quantity that is one larger.	**M.O.K.1.1** count forward to 20 and backward from 10 with and without manipulatives.	**0**	**2**	The NxG WV objective connects counting to cardinality.
	M.O.K.1.2 read, write, order, and compare numbers to 20 using multiple strategies (e.g. manipulatives, number line).	**0**	**2**	The NxG WV objective connects counting to cardinality.
M.K.CC.5 Count to answer "how many?" questions about as many as 20 things arranged in a line, a rectangular array, or a circle, or as many as 10 things in a scattered configuration; given a number from 1–20, count out that many objects.	**M.O.K.1.1** count forward to 20 and backward from 10 with and without manipulatives.	**0**	**2**	The NxG WV objective builds number sense by counting objects in a variety of arrangements.
	M.O.K.1.2 read, write, order, and compare numbers to 20 using multiple strategies (e.g. manipulatives, number line).	**0**	**2**	The NxG WV objective builds number sense by counting objects in a variety of arrangements.
M.K.CC.6 Identify whether the number of objects in one group is greater than, less than, or equal to the number of objects in another group, e.g., by using matching and counting strategies.	**M.O.K.1.1** count forward to 20 and backward from 10 with and without manipulatives.	**0**	**1**	The NxG WV objective connects mathematical language/vocabulary with counting strategies to build number sense.
	M.O.K.1.2 read, write, order, and compare numbers to 20 using multiple strategies (e.g. manipulatives, number line).	**0**	**2**	The NxG WV objective connects mathematical language/vocabulary with counting strategies to build number sense.
M.K.CC.7 Compare two numbers	**M.O.K.1.2** read, write, order, and	**0**	**3**	The NxG WV objective concentrates on

between 1 and 10 presented as written numerals.	compare numbers to 20 using multiple strategies (e.g. manipulatives, number line).			numbers to 10 to go deeper with number sense.
M.K.OA.1 Represent addition and subtraction with objects, fingers, mental images, drawings, sounds (e.g., claps), acting out situations, verbal explanations, expressions, or equations.	**M.O.K.1.8** use concrete objects to model addition and subtraction of whole numbers related to sums of 10 or less and write corresponding number sentence.	**0**	**3**	The NxG WV objective encourages the use of multiple strategies to represent addition and subtraction.
	M.O.K.1.9 model meanings of operations and the relationship between addition and subtraction (e.g., identity element of addition, commutative property) using manipulatives.	**0**	**2**	The NxG WV objective requires many developmentally appropriate ways to model addition and subtraction.
M.K.OA.2 Solve addition and subtraction word problems, and add and subtract within 10, e.g., by using objects or drawings to represent the problem.	**M.O.K.1.10** create grade-appropriate picture and story problems, solve using a variety of strategies, present solutions and justify results.	**0**	**3**	The NxG WV objective promotes deeper understanding with addition and subtraction word problems within objective M.O.K.1.10.
	M.O.K.1.8 use concrete objects to model addition and subtraction of whole numbers related to sums of 10 or less and write corresponding number sentence.	**0**	**2**	The NxG WV objective requires representation of addition and subtraction in multiple ways.
M.K.OA.3 Decompose numbers less than or equal to 10 into pairs in more than one way, e.g., by using objects or drawings, and record each decomposition by a drawing or equation (e.g., 5 = 2 + 3 and 5 = 4 + 1).	**M.O.K.1.2** read, write, order, and compare numbers to 20 using multiple strategies (e.g. manipulatives, number line).	**0**	**1**	The NxG WV objective introduces decomposing numbers to kindergarten students.
M.K.OA.4 For any number from 1 to 9, find the number that makes 10 when added to the given number, e.g., by using objects or drawings, and record the answer with a drawing or equation.	**M.O.K.1.8** use concrete objects to model addition and subtraction of whole numbers related to sums of 10 or less and write corresponding number sentence	**0**	**2**	The NxG WV objective incorporates drawing and/or writing equations for addition.
	M.O.K.1.9 model meanings of operations and the relationship between addition and subtraction (e.g., identity element of addition, commutative property) using	**0**	**2**	The NxG WV objective promotes in- depth understanding of addition to 10 using multiple methods of recording.

	manipulatives.			
M.K.OA.5 Fluently add and subtract within 5.	**M.O.K.1.8** use concrete objects to model addition and subtraction of whole numbers related to sums of 10 or less and write corresponding number sentence.	**0**	**2**	The NxG WV objective expects fluency with addition and subtraction to 5.
M.K.NBT.1 Compose and decompose numbers from 11 to 19 into ten ones and some further ones, e.g., by using objects or drawings, and record each composition or decomposition by a drawing or equation (e.g., 18 = 10 + 8); understand that these numbers are composed of ten ones and one, two, three, four, five, six, seven, eight, or nine ones.	**M.O.K.1.2** read, write, order, and compare numbers to 20 using multiple strategies (e.g. manipulatives, number line).	**0**	**1**	The NxG WV objective introduces place value through 19 in kindergarten.
M.K. MD.1 Describe measurable attributes of objects, such as length or weight. Describe several measurable attributes of a single object.	**M.O.K.4.3** compare two objects in nonstandard units of measure, according to one or more of the following attributes: • length • height • weight.	**0**	**3**	The NxG WV objective increases measurement vocabulary including multiple descriptors of a single object.
M.K. MD.2 Directly compare two objects with a measurable attribute in common, to see which object has "more of"/"less of" the attribute, and describe the difference. For example, directly compare the heights of two children and describe one child as taller/shorter.	**M.O.K.2.1** justify the classification of self-selected objects based on attributes.	**0**	**3**	The NxG WV objective promotes discussions regarding the comparisons of objects.
	M.O.K.4.3 compare two objects in nonstandard units of measure, according to one or more of the following attributes: • length • height • weight.	**0**	**1**	The NxG WV objective recommends the use of specific math vocabulary for comparing objects.
M.K. MD.3 Classify objects into given categories; count the numbers of objects in each category and sort the categories by count**.**	**M.O.K.5.1** collect, organize, display and interpret data using a pictograph and bar graph (with and without technology).	**0**	**1**	The NxG WV objective emphases classification and sorting of objects.
M.K.G.1 Describe objects in the	**M.O.K.3.2** recognize and describe	**0**	**2**	The NxG WV objective requires the use of

environment using names of shapes, and describe the relative positions of these objects using terms such as *above*, *below*, *beside*, *in front of*, *behind*, and *next to*.	basic geometric shapes in the environment.			specific math vocabulary.
	M.O.K.3.3 model and describe spatial relationships: • inside/outside • top/bottom • before/after.	**0**	**2**	The NxG WV objective increases mathematical language.
	M.O.1.3.6 describe spatial relationships: over/under, left/right.	**+1**	**3**	The NxG WV objective increases mathematical language.
M.K.G.2 Correctly name shapes regardless of their orientations or overall size.	**M.O.K.3.1** use physical materials to construct, identify, and classify basic geometric plane shapes: • circles • ellipses (oval) • rectangles including squares • triangles.	**0**	**1**	The NxG WV objective focus is on naming shapes regardless of their size or orientation.
M.K.G.3 Identify shapes as two-dimensional (lying in a plane, "flat") or three dimensional ("solid").	**M.O.K.3.1** use physical materials to construct, identify, and classify basic geometric plane shapes: • circles • ellipses (oval) • rectangles including squares • triangles	**0**	**1**	The NxG WV objective brings three-dimensional shapes to the kindergarten curriculum.
	M.O.1.3.3 recognize three-dimensional shapes in the environment.	**+ 1**	**3**	The NxG WV objective brings three-dimensional shapes to the kindergarten curriculum.
M.K.G.4 Analyze and compare two- and three-dimensional shapes, in different sizes and orientations, using informal language to describe their similarities, differences, parts (e.g., number of sides and vertices/"corners") and other attributes (e.g., having sides of equal length).	**M.O.K.3.2** recognize and describe basic geometric shapes in the environment.	**0**	**1**	The NxG WV objective promotes deeper understanding in the analysis of three-dimensional shapes (e.g.. sides, vertices/corners).
	M.O.K.4.1 estimate the size of an object and compare and order objects with respect to a given attribute.	**0**	**1**	The NxG WV objective develops informal language to describe two-and three-dimensional shapes.
	M.O.2.3.1 identify, describe the following geometric solids according to the number of faces and edges • cube • rectangular solid	**-2**	**1**	The NxG WV objective analyzes and compares all two- and three-dimensional shapes.

	• cylinder • cone • pyramid.			
M.K.G.5 Model shapes in the world by building shapes from components (e.g. sticks and clay balls) and drawing shapes.	**M.O.K.3.2** recognize and describe basic geometric shapes in the environment.	**0**	**3**	The NxG WV objective promotes modeling and building shapes.
M.K.G.6 Compose simple shapes to form larger shapes. *For example, "Can you join these two triangles with full sides touching to make a rectangle?"*	**M.O.K.3.1** use physical materials to construct, identify, and classify basic geometric plane shapes: • circles • ellipses (oval) • rectangles including squares • triangles	**0**	**2**	The NxG WV objective encourages the creation of new shapes from simple shapes.

First Grade Mathematics

How to Read the Crosswalk Document

The West Virginia Crosswalk document is designed to help readers easily understand the similarities and differences between the 21st Century Content Standards and Objectives for English Language Arts and Mathematics in WV Schools and the Next Generation WV Content Standards and Objectives for English Language Arts and Mathematics that have been aligned with the *Common Core State Standards for English Language Arts and Literacy in History/Social Studies, Science and Technical Subjects* and the *Common Core State Standards for Mathematics.*

NxG WV State Objective Aligned to CCSS	WV 21st Century Objective	Grade △	Alignment	Comment
M.1.OA.1 Use addition and subtraction within 20 to solve word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions, e.g., by using objects drawings, and equations with a symbol for the unknown number to represent the problem.	**M.O.1.1.10** use concrete objects to model the addition of two or three addends and subtraction of whole numbers related to sums less than 18 and write the corresponding number sentence.	0	1	NxG WV objective includes unknowns in all positions with the unknowns represented by symbols.
M.1.OA.2 Solve word problems that call for addition of three whole numbers whose sum is less than or equal to 20, e.g., by using objects, drawings, and equations with a symbol for the unknown number to	**M.O.1.1.10** use concrete objects to model the addition of two or three addends and subtraction of whole numbers related to sums less than 18 and write the corresponding number sentence.	0	1	NxG WV objective incorporates word problems, goes to 20, and uses more than just concrete objects. NxG WV objective includes symbols for unknown numbers.

represent the problem.	**M.O.1.2.2** determine the rule or give the output given an input/output model using addition or subtraction.	0	1	NxG WV objective emphasizes finding the unknown, regardless of its position.
M.1.OA.3 Apply properties of operations as strategies to add and subtract.3 Examples: If 8 + 3 = 11 is known, then 3 + 8 = 11 is also known. (Commutative property of addition.) To add 2 + 6 + 4, the second two numbers can be added to make a ten, so 2 + 6 + 4 = 2 + 10 = 12. (Associative property of addition.)	**M.O.1.1.11** model operations, addition and subtraction, and the relationship between addition and subtraction (e.g., identity element of addition, commutative property, fact families, inverse operations) using concrete objects.	0	3	NxG WV objective emphasizes properties of operations to add and subtract.
M.1.OA.4 Understand subtraction as an unknown-addend problem. For example, subtract 10 – 8 by finding the number that makes 10 when added to 8.	**M.O.1.2.2** determine the rule or give the output given an input/output model using addition or subtraction.	0	1	NxG WV objective emphasis focuses on understanding the relationship between subtraction and addition.
	M.O.1.1.11 model operations, addition and subtraction, and the relationship between addition and subtraction (e.g., identity element of addition, commutative property, fact families, inverse operations) using concrete objects.	0	2	NxG WV objective emphasis focuses on understanding the relationship between subtraction and addition.
M.1.OA.5 Relate counting to addition and subtraction (e.g., by counting on 2 to add 2).	**M.O.1.2.3** identify and write number patterns by 2's, 5's and 10's.	0	1	NxG WV objective emphasizes the relationship between counting patterns and addition/subtraction.
M.1.OA.6 Add and subtract within 20, demonstrating fluency for addition and subtraction within 10. Use strategies such as counting on; making ten(e.g., 8 + 6 = 8 + 2 + 4 = 10 + 4 = 14); decomposing a number leading to a ten (e.g., 13 – 4 = 13 – 3 – 1 = 10 – 1 = 9); using the relationship between addition and subtraction (e.g., knowing that 8 + 4 = 12, one knows 12 – 8= 4);	**M.O.1.1.10** use concrete objects to model the addition of two or three addends and subtraction of whole numbers related to sums less than 18 and write the corresponding number sentence.	0	1	NxG WV objective promotes the use of multiple strategies.
	M.O.1.1.11 model operations, addition and subtraction, and the relationship between addition and subtraction (e.g., identity element or addition, commutative property, fact	0	1	NxG WV objective includes strategies, as well as properties, and emphasizes fluency.

and creating equivalent but easier or known sums (e.g., adding 6 +7 by creating the known equivalent 6 + 6 + 1 = 12 + 1 = 13).	families, inverse operations) using concrete objects			
	M.O.1.1.12 quick recall of basic addition facts with sums to 10 and corresponding subtraction facts.	0	2	NxG WV objective promotes using strategies for fluency.
M.1.OA.7 Understand the meaning of the equal sign, and determine if equations involving addition and subtraction are true or false. For example, which of the following equations are true and which are false? 6 = 6, 7 = 8 – 1, 5 + 2 = 2 + 5, 4 + 1 = 5 + 2.	**M.O.1.1.10** use concrete objects to model the addition of two or three addends and subtraction of whole numbers related to sums less than 18 and write the corresponding number sentence.	0	1	NxG WV objective emphasizes using the equal sign to represent equality.
	M.O.1.2.5 Use concrete materials to demonstrate that the quantities on both sides of a grade-appropriate number sentence are equivalent.	0	2	NxG WV objective emphasizes using the equal sign to represent equality.
M.1.OA.8 Determine the unknown whole number in an addition or subtraction equation relating three whole numbers. For example, determine the unknown number that makes the equation true in each of the equations 8 +? = 11, 5 = □ – 3, 6 + 6 = □.	**M.O.1.1.10** use concrete objects to model the addition of two or three addends and subtraction of whole numbers related to sums less than 18 and write the corresponding number sentence.	0	1	NxG WV objective emphasizes finding the unknown in any position of an equation. The verb “determine” indicates the use of any strategy to complete the task.
M.1.NBT.1 Count to 120, starting at any number less than 120. In this range, read and write numerals and represent a number of objects with a written numeral.	**M.O.1.1.1** count forward to 100 and backward from 20 with and without manipulatives.	0	2	NxG WV objective counts to 120, starts counting at any number, and includes reading and writing numbers.
	M.O.1.1.2 read, write, order, and compare numbers to 100 using multiple strategies (e.g. manipulatives, number line, symbols).	0	3	NxG WV objective extends to 120.
M.1.NBT.2 Understand that the two digits of a two-digit number represent amounts of tens and ones. Understand the following as special cases: a. 10 can be thought of as a bundle of ten ones — called a “ten.”	**M.O.1.1.5** model and identify place value of each digit utilizing standard and expanded form to 100.	0	3	NxG WV objective identifies specific skills and vocabulary to build the foundation of place value.

b. The numbers from 11 to 19 are composed of a ten and one, two, three, four, five, six, seven, eight, or nine ones. **c.** The numbers 10, 20, 30, 40, 50, 60, 70, 80, 90 refer to one, two, three, four, five, six, seven, eight, or nine tens (and 0 ones).				
M.1.NBT.3 Compare two two-digit numbers based on meanings of the tens and ones digits, recording the results of comparisons with the symbols >, =, and <.	**M.O.1.1.2** read, write, order, and compare numbers to 100 using multiple strategies (e.g. manipulatives, number line, symbols).	0	3	NxG WV objective specifies the symbols >, <, =.
	M.O.1.1.5 model and identify place value of each digit utilizing standard and expanded form to 100.	0	2	NxG WV objective requires comparison of two numbers using symbols.
	M.O.1.2.5 use concrete materials to demonstrate that the quantities on both sides of a grade-appropriate number sentence are equivalent.	0	1	NxG WV objective requires comparison of two numbers using symbols.
M.1.NBT.4 Add within 100, including adding a two-digit number and a one-digit number, and adding a two-digit number and a multiple of 10, using concrete models or drawings 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. Understand that in adding two-digit numbers, one adds tens and tens, ones and ones; and sometimes it is necessary to compose a ten.	**M.O.1.1.11** model operations, addition and subtraction, and the relationship between addition and subtraction (e.g., identity element of addition, commutative property, fact families, inverse operations) using concrete objects.	0	1	NxG WV objective emphasizes a variety of strategies and asks students to explain their reasoning. NxG WV objective includes the strategy of composing a ten.
	M.O.1.1.13 model and solve 2-digit addition and subtraction without regrouping.	0	1	NxG WV objective includes regrouping, using strategies, and explaining reasoning.
M.1.NBT.5 Given a two-digit number, mentally find 10 more or	**M.O.1.1.13** model and solve 2-digit addition and subtraction without	0	1	NxG WV objective stresses finding 10 more/10 less, using

10 less than the number, without having to count; explain the reasoning used.	regrouping.			mental strategies.
M.1.NBT.6 Subtract multiples of 10 in the range 10-90 from multiples of 10 in the range 10-90 (positive or zero differences), using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used.	**M.O.1.1.11** model operations, addition and subtraction, and the relationship between addition and subtraction (e.g., identity element of addition, commutative property, fact families, inverse operations) using concrete objects.	0	1	NxG WV objective focuses on the strategy of using multiples of ten and asks students to explain their reasoning.
	M.O.1.1.13 model and solve 2-digit addition and subtraction without regrouping.	0	1	NxG WV objective focuses on multiples of ten and asks for explanation of reasoning.
M.1.MD.1 Order three objects by length; compare the lengths of two objects indirectly by using a third object.	**M.O.1.4.1** estimate, measure, compare and order using customary, metric, and nonstandard units to determine length to nearer whole unit.	0	2	NxG WV objective emphasizes ordering and comparing lengths without actually measuring.
M.1.MD.2 Express the length of an object as a whole number of length units, by laying multiple copies of a shorter object (the length unit) end to end; understand that the length measurement of an object is the number of same-size length units that span it with no gaps or overlaps. Limit to contexts where the object being measured is spanned by a whole number of length units with no gaps or overlaps.	**M.O.1.4.1** estimate, measure, compare and order using customary, metric, and nonstandard units to determine length to nearer whole unit.	0	2	NxG WV objective limits measurement to nonstandard units and emphasizes iteration (the art of measuring).
M.O.1.MD.3 Tell and write time in hours and half-hours using analog and digital clocks.	**M.O.K.4.5**.read time to the hour using analog and digital clocks.	+1	2	NxG WV objective goes to half-hour time.
	M.O.1.4.5 read time to the half hour using an analog and digital clock.	0	3	NxG WV objective adds writing time.
M.1.MD.4 Organize, represent, and interpret data with up to three	**M.O.1.5.1** identify a real life situation to gather data over time; make	0	2	NxG WV objective focuses on representing and interpreting

categories; ask and answer questions about the total number of data points, how many in each category, and how many more or less are in one category than in another.	hypothesis as to the outcome; design and implement a method to collect, organize, and analyze the results to make a conclusion; evaluate the validity of the hypothesis based upon collected data; design a mode of presentation using a pictograph and a bar graph (with and without technology).			the data.
	M.O.3.5.3 analyze real-world data represented on a graph using grade-appropriate questions.	-2	3	NxG WV objective provides specific examples of grade-appropriate questions.
M.1.G.1 Distinguish between defining attributes (e.g., triangles are closed and three-sided) versus non-defining attributes (e.g., color, orientation, overall size); build and draw shapes to possess defining attributes.	**M.O.1.2.1** sort and classify objects by more than one attribute, using various strategies, including Venn Diagrams.	0	2	NxG WV objective distinguishes between defining and non-defining attributes.
	M.O.1.3.1 draw, label, and sort • circle, • rectangles including squares, • triangles, and • according to sides and vertices.	0	2	NxG WV objective distinguishes between defining and non-defining attributes. NxG WV objective also asks students to build shapes.
	M.O.3.3.2 identify, describe, and classify the following geometric solids according to the number of faces, edges, and vertices: • cube • rectangular solid • cylinder • cone • •pyramid.	-2	2	NxG WV objective asks students to build and draw shapes.
M.1.G.2 Compose two-dimensional shapes (rectangles, squares, trapezoids, triangles, half-circles, and quarter-circles) or three-dimensional shapes (cubes, right rectangular prisms, right circular cones, and right circular cylinders) to create a composite shape, and	**M.O.1.3.1** draw, label, and sort • circle, • rectangles including squares, • triangles, and • according to sides and vertices.	0	1	NxG WV objective emphasizes working with composite shapes.
	M.O.1.3.2 use physical materials to construct, identify, and classify three-	0	1	NxG WV objective emphasizes working with composite

compose new shapes from the composite shape.	dimensional figures: • cube • cone • sphere • rectangular solid • pyramid • cylinder.			shapes.
	M.O.1.3.8 predict the result of combining or decomposing two or more two-dimensional/three-dimensional shapes.	0	2	NxG WV objective requires building the composite shape.
M.1.G.3 Partition circles and rectangles into two and four equal shares, describe the shares using the words halves, fourths, and quarters, and use the phrases half of, fourth of, and quarter of. Describe the whole as two of, or four of the shares. Understand for these examples that decomposing into more equal shares creates smaller shares.	**M.O.1.1.9** identify, name, and explain why a given part is a half, third or fourth of a whole or part of a group, using concrete models.	0	2	NxG WV objective focuses on halves and fourths (quarters) of a whole. NxG WV objective asks students to partition. NxG WV objective provides specific vocabulary.
	M.O.K.1.7 identify and name halves and wholes using concrete models.	+1	1	NxG WV objective includes fourths and has students doing the partitioning. NxG WV objective provides specific vocabulary.
	M.O.K.3.4 identify the separate parts used to make a whole object.	+1	1	NxG WV objective is specific about halves and fourths and has students doing the partitioning. NxG WV objective suggests specific vocabulary.

Second Grade Mathematics

How to Read the Crosswalk Document

The West Virginia Crosswalk document is designed to help readers easily understand the similarities and differences between the 21st Century Content Standards and Objectives for English Language Arts and Mathematics in WV Schools and the Next Generation WV Content Standards and Objectives for English Language Arts and Mathematics that have been aligned with the *Common Core State Standards for English Language Arts and Literacy in History/Social Studies, Science and Technical Subjects* and the *Common Core State Standards for Mathematics.*

NxG WV State Objective Aligned to CCSS	WV 21st Century Objective	Grade △	Alignment	Comment
M.2.OA.1 Use addition and subtraction within 100 to solve one- and two-step word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem.	**M.O.2.1.13** create story problems that require one or two-step procedures, using a variety of strategies explain the reasoning used, justify the procedures selected and present the results.	0	2	NxG WV objective concentrates on number sense to solve word problems using different representations.
M.2.OA.2 Fluently add and subtract within 20 using mental strategies. By end of Grade 2, know from memory all sums of two one-digit numbers.	**M.O.2.1.9** demonstrate quick recall of basic addition facts with sums to 18 and corresponding subtraction facts.	0	3	NxG WV objective emphasizes knowing from memory basic facts to 20.

M.2.OA.3 Determine whether a group of objects (up to 20) has an odd or even number of members, e.g., by pairing objects or counting them by 2s; write an equation to express an even number as a sum of two equal addends.	**M.O.2.1.2** justify any number as odd or even and determine if a set has an odd or even number of elements.	0	3	NxG WV objective develops an understanding of odd and even numbers.
	M.O.1.1.3 identify odd and even numbers to 20 and determine if a set of objects has an odd or even number of elements.	+1	3	NxG WV objective completely encompasses the skill of identifying odd and even numbers. In addition students write equations.
M.2.OA.4 Use addition to find the total number of objects arranged in rectangular arrays with up to 5 rows and up to 5 columns; write an equation to express the total as a sum of equal addends.	**M.O.3.1.9** demonstrate and model multiplication (repeated addition, arrays) and division (repeated subtraction, partitioning).	-1	3	NxG WV objective focuses on the use of arrays to lay the foundation for understanding of multiplication..
M.2.NBT.1 Understand that the three digits of a three-digit number represent amounts of hundreds, tens, and ones; e.g., 706 equals 7 hundreds, 0 tens, and 6 ones. Understand the following as special cases: a. 100 can be thought of as a bundle of ten tens — called a"hundred." **b.** The numbers 100, 200, 300, 400, 500, 600, 700, 800, 900 refer to one, two, three, four, five, six, seven, eight, or nine hundreds (and 0 tens and 0 ones).	**M.O.2.1.3** count and group concrete manipulatives by ones, tens, and hundreds to 1,000.	0	3	NxG WV objective requires a greater depth of knowledge of place value.
	M.O.2.1.4 model and identify place value of each digit utilizing standard and expanded form through 1000.	0	3	NxG WV objective requires a greater depth of knowledge of place value.
M.2.NBT.2 Count within 1000; skip-count by 5s, 10s, and 100s.	**M.O.2.1.3** count and group concrete manipulatives by ones, tens, and hundreds to 1,000.	0	1	NxG WV objective includes counting by fives.
M.2.NBT.3 Read and write numbers to 1000 using base-ten numerals, number names, and expanded form.	**M.O.2.1.1** read, write, order, and compare numbers to 1,000 using multiple strategies (e.g. symbols, manipulatives, number line).	0	2	NxG WV objective emphasizes reading and writing numbers including expanded form.
	M.0.3.1.3 identify place value of each digit utilizing standard and expanded form to 10,000.	-1	1	NxG WV objective focuses on reading and writing numbers to 1,000.
M.2.NBT.4 Compare two three-digit	**M.O.2.1.1** read, write, order, and	0	3	NxG WV objective uses specific symbols

numbers based on meanings of the hundreds, tens, and ones digits, using >, =, and < symbols to record the results of comparisons.	compare numbers to 1,000 using multiple strategies (e.g. symbols, manipulatives, number line).			to compare numbers.
M.2.NBT.5 Fluently add and subtract within 100 using strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.	**M.O.2.1.8** model and justify the relationship between addition and subtraction (e.g., identity element of addition, associative property, commutative property, inverse operations, fact families).	0	3	NxG WV objective has a strong alignment between objectives with increased emphasis on strategies.
M.2.NBT.6 Add up to four two-digit numbers using strategies based on place value and properties of operations.	**M.O.2.1.11** add and subtract 2- and 3-digit numbers without regrouping.	0	2	NxG WV objective includes the use of strategies when adding two or more two-digit numbers.
M.2.NBT.7 Add and subtract within 1000, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method. Understand that in adding or subtracting three digit numbers, one adds or subtracts hundreds and hundreds, tens and tens, ones and ones; and sometimes it is necessary to compose or decompose tens or hundreds.	**M.O.2.1.10** model 2- and 3-digit addition and subtraction with regrouping using multiple strategies.	0	3	NxG WV objective emphasizes the understanding of the relationship between addition and subtraction including the need to compose and decompose tens/hundreds.
M.2.NBT.8 Mentally add 10 or 100 to a given number 100–900, and mentally subtract 10 or 100 from a given number 100–900.	**M.O.2.1.11** add and subtract 2 and 3 digit numbers without regrouping.	0	2	NxG WV objective focuses on mentally adding or subtracting 10 or 100 to/from a given number.
M.2.NBT.9 Explain why addition and subtraction strategies work, using place value and the properties of operations.	**M.O.2.1.8** model and justify the relationship between addition and subtraction (e.g., identity element of addition, associative property, commutative property, inverse operations, fact families).	0	3	NxG WV objective has a strong emphasis on strategies as well as properties related to addition and subtraction.
M.2.MD.1 Measure the length of an object by selecting and using	**M.O.2.4.1** identify a real life situation to use appropriate measurement	0	1	NxG WV objective emphasizes the measurement of length using appropriate

appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes.	tools; over time make a hypothesis as to the change overtime using whole units: • length in centimeters and inches, • temperature in Celsius and Fahrenheit, • weight/mass in pounds and kilograms, and design and implement a method to collect, organize, and analyze data; analyze the results to make a conclusion evaluate the validity of the hypothesis based upon collected data; design a mode of presentation (with and without technology).			tools.
	M.O.1.4.2 select appropriate units and tools to measure and compare two objects or events according to one or more of the following attributes: • length • height • weight • temperature • volume justify selection of units and tools used to measure the attributes and present results.	+1	1	NxG WV objective emphasizes the measurement of length using appropriate tools.
M.2.MD.2 Measure the length of an object twice, using length units of different lengths for the two measurements; describe how the two measurements relate to the size of the unit chosen.	**M.O.2.4.1** identify a real life situation to use appropriate measurement tools; over time make a hypothesis as to the change overtime using whole units: • length in centimeters and inches, • temperature in Celsius and Fahrenheit,	0	1	NxG WV objective explores the relationship between different units when measuring length of the same object.

	weight/mass in pounds and kilograms, and design and implement a method to collect, organize, and analyze data; analyze the results to make a conclusion evaluate the validity of the hypothesis based upon collected data; design a mode of presentation (with and without technology).			
M.2.MD.3 Estimate lengths using units of inches, feet, centimeters, and meters.	**M.O.2.4.2** estimate and determine the perimeter of squares, rectangles, and triangles.	0	2	NxG WV objective emphasizes estimating using a variety of units.
M.2.MD.4 Measure to determine how much longer one object is than another, expressing the length difference in terms of a standard length unit.				
M.2.MD.5 Use addition and subtraction within 100 to solve word problems involving lengths that are given in the same units, e.g., by using drawings (such as drawings of rulers) and equations with a symbol for the unknown number to represent the problem.	**M.O.2.1.13** create story problems that require one or two-step procedures, using a variety of strategies, explain the reasoning used, justify the procedures selected and present the results.	0	1	NxG WV objective incorporates the use of story problems involving length.
M.2.MD.6 Represent whole numbers as lengths from 0 on a number line diagram with equally spaced points corresponding to the numbers 0, 1, 2, ..., and represent whole-number sums and differences within 100 on a number line diagram.	**M.O.2.1.1** read, write, order, and compare numbers to 1,000 using multiple strategies (e.g. symbols, manipulatives, number line).	0	1	NxG WV objective focuses on using number lines to represent length.
M.2.MD.7 Tell and write time from analog and digital clocks to the nearest five minutes, using a.m. and p.m.	**M.O.2.4.6** read time to the quarter hour using an analog and digital clock.	0	2	NxG WV objective emphasizes telling and writing time to the nearest five minutes and uses a.m. and p.m.
	M.O.3.4.4 read time to 5-minute intervals using (am and pm) analog and digital clocks, compute elapsed time to the quarter-hour using a	-1	2	NxG WV objective requires writing time to the nearest five minutes.

	clock.			
M.2.MD.8 Solve word problems involving dollar bills, quarters, dimes, nickels, and pennies, using $ and ¢ symbols appropriately. Example: If you have 2 dimes and 3 pennies, how many cents do you have?	**M.O.1.4.6** identify, count, trade and organize the following coins and bill to display a variety of price values from real-life examples with a total value of 100 cents or less. • penny • nickel • dime • quarter • dollar bill .	+1	2	NxG WV objective explores money by solving word problems using the appropriate symbols.
	M.O.2.4.7 identify, count and organize coins and bills to display a variety of price values from real-life examples with a total value of one dollar or less and model making change using manipulatives.	0	2	NxG WV objective emphasizes solving word problems relating to money.
	M.O.3.4.5 identify, count and organize coins and bills to display a variety of price values from real-life examples with a total value of $100 or less and model making change using manipulatives.	-1	2	NxG WV objective emphasizes solving word problems relating to money.
M.2.MD.9 Generate measurement data by measuring lengths of several objects to the nearest whole unit, or by making repeated measurements of the same object. Show the measurements by making a line plot, where the horizontal scale is marked off in whole-number units.	**M.O.2.4.1** identify a real life situation to use appropriate measurement tools; over time make a hypothesis as to the change overtime using whole units: • length in centimeters and inches, • temperature in Celsius and Fahrenheit, • weight/mass in pounds and kilograms, and design and implement a method to collect, organize, and analyze data; analyze the results to make a conclusion evaluate the validity of the hypothesis based upon	0	1	NxG WV objective stresses the use of line plots to display information.

	collected data; design a mode of presentation (with and without technology).			
M.2.MD.10 Draw a picture graph and a bar graph (with single-unit scale) to represent a data set with up to four categories. Solve simple put together, take-apart, and compare problems using information presented in a bar graph.	**M.O.2.4.1** identify a real life situation to use appropriate measurement tools; over time make a hypothesis as to the change overtime using whole units: • length in centimeters and inches, • temperature in Celsius and Fahrenheit, • weight/mass in pounds and kilograms, and design and implement a method to collect, organize, and analyze data; analyze the results to make a conclusion evaluate the validity of the hypothesis based upon collected data; design a mode of presentation (with and without technology).	0	1	NxG WV objective requires the designing of picture graphs or bar graphs to display data.
	M.O.2.5.1 create, read, and interpret a pictograph with each picture representing greater than or equal to a single unit.	0	2	NxG WV objective extends the interpretations of picture graphs to bar graphs.
	M.O.2.5.3 analyze data represented on a graph using grade-appropriate questions.	0	1	NxG WV objective focuses on picture graphs and bar graphs.
	M.O.2.5.4 formulate questions, collect data, organize and display as a chart, table or bar graph.	0	2	NxG WV objective promotes the use of picture graphs and bar graphs up to four categories.
M.2.G.1 Recognize and draw shapes having specified attributes, such as a given number of angles or a given number of equal faces. Identify triangles, quadrilaterals, pentagons, hexagons, and cubes.	**M.O.2.3.1** identify and describe the following geometric solids according to the number of faces and edges: rectangular solid, cube, cylinder, cone, pyramid	0	1	NxG WV objective explores the attributes of plane shapes as well as cubes.
	M.O.2.3.6 identify similar shapes	0	1	NxG WV objective incorporates the drawing of shapes with specified

				attributes.
	M.O.2.3.2 compare and contrast plane and solid geometric shapes.	0	1	NxG WV objective focuses on attributes to recognize and draw shapes.
M.2.G.2 Partition a rectangle into rows and columns of same-size squares and count to find the total number of them.	**M.O.2.4.3** estimate and count the number of square units needed to cover a given area using manipulatives.	0	3	NxG WV objective emphasizes partitioning of a rectangle.
M.2.G.3 Partition circles and rectangles into two, three, or four equal shares, describe the shares using the words halves, thirds, half of, a third of, etc., and describe the whole as two halves, three thirds, four fourths. Recognize that equal shares of identical wholes need not have the same shape.	**M.O.2.1.7** identify and explain fractions as part of a whole and as part of a set/group using models.	0	2	NxG WV objective focuses on halves, thirds and fourths using circles and rectangles.

Third Grade Mathematics

How to Read the Crosswalk Document

The West Virginia Crosswalk document is designed to help readers easily understand the similarities and differences between the 21st Century Content Standards and Objectives for English Language Arts and Mathematics in WV Schools and the Next Generation WV Content Standards and Objectives for English Language Arts and Mathematics that have been aligned with the *Common Core State Standards for English Language Arts and Literacy in History/Social Studies, Science and Technical Subjects* and the *Common Core State Standards for Mathematics.*

NxG WV State Objective Aligned to CCSS	WV 21st Century Objective	Grade △	Alignment	Comment
M.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 context in which a total number of objects can be expressed as 5 × 7.*	**M.O.3.1.9 demonstrate and model multiplication (repeated addition, arrays)** and division (repeated subtraction, partitioning).	0	2	NxG WV objective requires a greater depth of knowledge to interpret products.
M.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	**M.O.3.1.9** demonstrate and model multiplication [repeated addition, arrays] and **division [repeated subtraction, partitioning].**	0	2	NxG WV objective requires a greater depth of knowledge to interpret quotients.
	M.O.3.1.13 use models to demonstrate division of 2- and 3-digit	0	2	NxG WV objective requires a greater depth of knowledge to interpret quotients.

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.*	numbers by a 1-digit number.			
M.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.	**M.O.3.1.9** demonstrate and model multiplication [repeated addition, arrays] and division [repeated subtraction, partitioning].	0		NxG WV objective strongly aligns by emphasizing the understanding of multiplication and division, and then allows students to apply this knowledge to solve word problems.
M.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 = ?.*	**M.O.3.1.11** recall basic multiplication facts and the corresponding division facts.	0	2	NxG WV objective aligns the recall of basic multiplication and division facts to the relationship of using facts to find an unknown.
M.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.]*	**M.O.3.1.10** use and explain the operations of multiplication and division including the properties [e.g., identity element of multiplication, commutative property, property of zero, associative property, inverse operations].	0	3	NxG WV objective reflects a strong alignment.
M.3.OA.6 Understand division as an unknown-factor problem. *For example, find 32 ÷ 8 by finding the number that makes 32 when*	**M.O.3.1.11** recall basic multiplication facts and the corresponding division facts.	0	2	NxG WV objective expands the understanding of division by showing division's relationship to multiplication to find an unknown factor.

multiplied by 8.				
M.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.	**M.O.3.1.11** recall basic multiplication facts and the corresponding division facts.	0	3	NxG WV objective emphasizes fluency and mastery of these facts by the end of 3rd grade.
	M.O.3.1.12 model the distributive property in multiplication of 2- and 3-digit numbers by a 1-digit number.	0	3	NxG WV objective includes the use of all properties of operations and stresses mastery of facts.
	M.O.4.1.9 quick recall of basic multiplication facts and corresponding division facts.	-1	3	NxG WV objective emphasizes the mastery of basic multiplication and division facts by 3rd grade.
M.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.	**M.O.2.1.12** use rounding to analyze the reasonableness of a **sum or a difference.**	+1	2	NxG WV objective emphasizes estimation and rounding to solve two-step word problems extending to all 4 operations.
	M.O.3.2.5 use symbol and letter variables to represent an unknown quantity and determine the value of the variable**.**	0	3	NxG WV objective extends the use of letter variables in equations to solve two-step word problems.
	M.O. 3.1.14 create grade-appropriate real-world problems involving any of the four operations using multiple strategies, explain the reasoning uses, and justify the procedures selected when presenting solutions.	0	3	NxG WV objective reflects a strong alignment.
	M.O.5.1.3 estimate solutions to problems involving whole numbers, decimals, fractions, and percents to determine reasonableness using benchmarks.	-2	3	NxG WV objective focuses on the use of estimation to determine reasonableness of solutions when solving two-step word problems.
M.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.*	**M.O.1.2.4** create and analyze number patterns based on real-life situations using words, A B form, and T-charts and present results.	2	1	NxG WV objective focuses on connecting properties of operations to arithmetic patterns.
	M.O.3.2.3 analyze a given pattern and write the rule.	0	3	NxG WV objective focuses on connecting properties of operations to arithmetic patterns.
M.3.NBT.1 Use place value understanding to round whole	**M.O.2.1.6** round any three-digit number to both the nearer 10 and	+1	3	NxG WV objective reflects a strong alignment.

numbers to the nearest 10 or 100.	100.			
	M.O.3.1.4 apply estimation skills [**rounding**, benchmarks, compatible numbers] to solve and evaluate reasonableness of an answer.	0	2	NxG WV objective requires a solid understanding of place value to round whole numbers.
M.3.NBT.2 Fluently add and subtract within 1000 using strategies and algorithms based on place value, properties of operations, and/or the relationship between addition and subtraction.	**M.O.3.1.8** add and subtract 2- and 3-digit whole numbers and money with and without regrouping.	0	3	NxG WV objective includes strategies to help students add and subtract fluently.
M.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.	**M.O.3.1.10** use and explain the **operations of multiplication** and division including the properties [e.g., identity element of multiplication, commutative property, property of zero, associative property, inverse operations].	0	2	NxG WV objective uses understanding of place value and properties of operations to multiply by multiples of 10.
M.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.	**M.O.3.1.5** demonstrate an understanding of fractions as **part of a whole/one** and as part of a set/group using models and pictorial representations.	0	3	NxG WV objective reflects a strong alignment.
M.3.NF.2 Understand a fraction as a number on the number line; represent fractions on a number line diagram. 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 to *b* equal parts. Recognize that each part has size 1*/b* and the endpoint of the part based at 0 locates the number 1*/b* on the number line. b. Represent a fraction *a/b* on	**M.O.4.1.4** Using concrete models, **benchmark fractions, number line** • Compare and order fractions with like and unlike denominators • Add and subtract fractions with like and unlike denominators • Model equivalent fractions • Model addition and subtraction of mixed numbers with and without regrouping.	-1	1	NxG WV objective emphasizes fractions (1/b intervals) as they correspond to a point on a number line.

a number line diagram by marking off *a* length 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.				
M.3.NF.3 Explain equivalence of fractions in special cases, and compare fractions by reasoning about their size. 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.** d. Compare two fractions with the same numerator or the same denominator by reasoning about their size. Recognize that comparisons are valid only when the two fractions	**M.O.3.1.6** create concrete models and pictorial representations to • compare and order fractions with like and unlike denominators, • Add and subtract fractions with like denominators, and verify results.	0	2	NxG WV objective expands equivalent fraction understanding and the comparing and ordering of fractions with like numerators or like denominators.
	M.O.3.1.7 use concrete models and pictorial representations to demonstrate an **understanding of equivalent fractions**, proper and improper fractions, and mixed numbers.	0	2	NxG WV objective emphasizes in-depth understanding of equivalent 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.				
M.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.	**M.O.2.4.4** Order events in relation to time.	+1	2	NxG WV objective emphasizes the use of a number line to solve problems with intervals of time.
	M.O.3.4.4 Read time to 5-minute intervals [am and pm] using analog and digital clocks, compute elapsed time to the quarter-hour using a clock**.**	0	3	NxG WV objective extends the telling and writing of time to the nearest minute intervals.
M.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.	**M.O. 3.4.1** Within a project based investigation, identify a real life situation, consider a number of variables and use appropriate measurement tools, overtime, make a hypothesis as to the change overtime with more precision than whole units; • Length in centimeters and inches, • Temperature in Celsius and Fahrenheit • **Weight/mass in pounds and** kilograms, and design and implement a method to collect, organize, and analyze data; analyze results to make a conclusion evaluate the validity of the hypothesis upon collected data; design a mode of presentation [with and without technology].	0	2	NxG WV objective is focused on measuring and estimating liquid volume and masses of objects.
	M.O.5.4.6 estimate and/or measure the weight/mass of real objects in ounces, pounds, grams, and kilograms.	-2	3	NxG WV objective includes measuring and estimating liquid volumes, as well as masses of objects.

M.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.	**M.O.3.5.1** collect and organize grade-appropriate real-world data from observation, surveys, and experiments, and identify and construct appropriate ways to display data.	0	3	NxG WV objective expands using the data compiled on graphs to solve one and two-step word problems.
M.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.	**M.O. 3.4.1** Within a project based investigation, identify a real life situation, consider a number of variables and use appropriate measurement tools, overtime, make a hypothesis as to the change overtime with more precision than whole units; • **Length in centimeters and inches,** • Temperature in Celsius and Fahrenheit • Weight/mass in pounds and kilograms, and design and implement a method to collect, organize, and analyze data; analyze results to make a conclusion evaluate the validity of the hypothesis upon collected data; design a mode of presentation [with and without technology].	0	3	NxG WV objective expands measuring lengths to units in whole numbers, halves, and quarters and displays the data using a line plot.
M.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	**M.O.2.4.3** estimate and count the number of square units needed to cover a given area using manipulatives.	+1	2	NxG WV objective expands on counting squares to find the area by understanding the concept of area measurement using unit squares.

be covered without gaps or overlaps by *n* unit squares is said to have an area of *n* square units.				
M.3.MD.6 Measure areas by counting unit squares [square cm, square m, square in, square ft, and improvised units].	**M.O.3.4.2 estimate** and find the perimeter and **area of familiar geometric shapes, using manipulatives, grids**, or appropriate measuring tools.	0	2	NxG WV objective focuses on counting unit squares to find area.
M.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 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 an x b and a x c. Use area models to represent the distributive property in mathematical reasoning. **d.** Recognize area as additive. Find areas of	**M.O.3.4.3** determine the formula the area of a rectangle and **explain reasoning through modeling**.	0	3	NxG WV objective gives detailed steps for using tiling to discover the relationship of the length of the sides of a rectangle to finding its area by multiplying.

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.				
M.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.	**M.O.2.4.2** estimate and determine the perimeter of squares, rectangles and triangles.	+1	3	NxG WV objective requires depth of knowledge of perimeters by solving real world problems.
M.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.	**M.O.4.3.1 identify, classify, compare and contrast 2 dimensional (including quadrilateral shapes)** and 3 dimensional **geometric figures according to attributes.**	-1	3	NxG WV objective requires depth of knowledge of attributes to compare different categories of polygons.
M.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 ¼ or the area of the shape.	**M.O.1.1.**9 **identify, name, and explain why a given part is a half, third, or fourth of a whole** or part of a group, using concrete models.	+2	2	NxG WV objective requires the partitioning of shapes to identify fractional parts of a whole.

Fourth Grade Mathematics

How to Read the Crosswalk Document

The West Virginia Crosswalk document is designed to help readers easily understand the similarities and differences between the 21st Century Content Standards and Objectives for English Language Arts and Mathematics in WV Schools and the Next Generation WV Content Standards and Objectives for English Language Arts and Mathematics that have been aligned with the *Common Core State Standards for English Language Arts and Literacy in History/Social Studies, Science and Technical Subjects* and the *Common Core State Standards for Mathematics.*

NxG WV State Objective Aligned to CCSS	WV 21st Century Objective	Grade	Alignment	Comment
M.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.	**M.O.3.1.10** Use and **explain the operations of multiplication** and division including the properties (e.g., identity element of multiplication, commutative property, property of zero, associative property, inverse operations).	+1	1	The NxG WV objective focuses on interpreting multiplication as a comparison.
M.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	**M.O.3.1.9** demonstrate and model multiplication (repeated addition, arrays) and division (repeated subtraction, partitioning).	+1	2	The NxG WV objective leads students to distinguish multiplicative comparison from additive comparison.

comparison.				
M.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.	**M.O.4.1.3** estimate solutions to problems including rounding, benchmarks, compatible numbers and evaluate the reasonableness of the solution, justify results.	0	2	The NxG WV objective emphasizes problem solving and extends student learning to using estimation to verify solutions.
	M.O.4.2.3 represent the idea of a variable as an unknown quantity using a letter, write an expression using a variable to describe a real-world situation.	0	3	The NxG WV objective directs students to solve multistep problems with the unknown represented as a variable.
M.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.	**M.O.5.1.4** use inductive reasoning to identify the divisibility rules of 2, 3, 5, 9 and 10 and apply the rules to solve application problems.	-1	2	The NxG WV objective includes factors and multiples and extends learning to include prime and composite numbers.
	M.O.5.2.4 model identify and describe square, prime and composite numbers.	-1	2	The NxG WV objective includes factors and multiples and extends learning to include prime and composite numbers.
M.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.*	**M.O.4.2.1** determine the rule and explain how change in one variable relates to the change in the second variable, given an input/output model using two operations.	0	2	The NxG WV objective gives the rule and asks the students to generate the pattern and then extend the experience to identify additional, non-specified patterns and explain them.
	M.O.3.2.1 analyze and extend geometric and numeric patterns.	+1	2	The NxG WV objective provides the rule and asks the student to generate the pattern. Students are asked to look for additional rules/patterns.
	M.O.3.2.2 create an input/output model using addition, subtraction, multiplication or division.	+1	1	The NxG WV objective asks the students to generate the pattern. Input/output model could be used to display the pattern but is not required.
	M.O.2.2.1 analyze, describe, extend and create a growing pattern using objects or numbers.	+2	3	The NxG WV objective strongly aligns

	M.O.2.2.3 describe, complete and extend a variety of counting patterns, according to a given rule.	+2	3	The NxG WV objective strongly aligns.
M.4.NBT.1 Recognize that in a multi-digit whole number, a digit in one place represents ten times what it represents in the place to its right. *For example, recognize that 700 ÷ 70 = 10 by applying concepts of place value and division.*	**M.O.4.1.2** demonstrate an understanding of the place value of each digit utilizing standard and expanded form through 1,000,000 with multiples of 10 [(5 X 10,000) + (3 X 1,000) + (4 X 10) + 2].	0	3	The NxG WV objective strongly aligns.
M.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.	**M.O.4.1.1 read, write, order, and compare whole numbers to the millions place** and decimals to thousandths place using a variety of strategies (e.g. **symbols,** manipulatives, number line, pictorial representations).	0	2	The NxG WV objective focuses on whole numbers to the millions place.
	M.O.4.1.2 demonstrate an understanding of the place value of each digit utilizing standard and expanded form through 1,000,000 with multiples of 10 [(5 X 10,000) + (3 X 1,000) + (4 X 10) + 2].	0	3	The NxG WV objective strongly aligns.
M.4.NBT.3 Use place value understanding to round multi-digit whole numbers to any place.	**M.O.2.1.6** Round any 3-digit number to both the nearer 10 and 100.	+2	3	The NxG WV objective focuses on rounding to any place value up to 1 million.
M.4.NBT.4 Fluently add and subtract multi-digit whole numbers using the standard algorithm.	**M.O.4.1.7 add and subtract whole numbers (up to five –digit number)** and decimals to the 1000th place, multiply (up to three digits by two-digits, and divide (up to a three digit number with a one and two-digit number).	0	2	The NxG WV objective has a specific focus on adding and subtracting multi-digit whole numbers.
M.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	**M.O.4.1.7** add and subtract whole numbers (up to five –digit number) and decimals to the 1000th place, **multiply (up to three digits by two-digits,** and divide (up to a three digit number with a one and two-digit	0	2	The NxG WV objective has a specific focus on multiplying multi-digit whole numbers. The emphasis is on using multiple strategies. The standard algorithm is addressed in fifth grade.

operations. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.	number).			
	M.O.4.1.8 solve multi-digit whole number multiplication problems using a variety of strategies, including the standard algorithm, justify methods used.	0	3	. The NxG WV objective has a specific focus on multiplying multi-digit whole numbers. The emphasis is on using multiple strategies. Mastery of the standard algorithm is expected in fifth grade.
M.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.	**M.O.4.1.7** add and subtract whole numbers (up to five –digit number) and decimals to the 1000th place, multiply (up to three digits by two-digits, and **divide (up to a three digit number with a one** and two-**digit number**).	0	2	The NxG WV objective concentrates on division of multi-digit whole numbers.
M.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.	**M.O.4.1.4** using concrete models, benchmark fractions, number line • compare and order fractions with like and unlike denominators • add and subtract fractions with like and unlike denominators • **model equivalent fractions** model addition and subtraction of mixed numbers with and without regrouping.	0	1	The NxG WV objective focuses on understanding equivalent fractions.
M.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	**M.O.4.1.4 using concrete models, benchmark fractions, number line** • **compare and order fractions with like and unlike denominators** • add and subtract fractions with like and unlike denominators • **model equivalent fractions** model addition and subtraction of	0	2	The NxG WV objective asks students to extend their knowledge of whole numbers to fractions. Students compare and build fractions using multiple strategies; they are expected to be able to reason abstractly about fractions.

symbols >, =, or <, and justify the conclusions, e.g., by using a visual fraction model. Build fractions from unit fractions by applying and extending previous understandings of operations on whole numbers.	mixed numbers with and without regrouping.			
M.4.NF.3 Understand a fraction a/b with a > 1 as a sum of fractions 1/b. 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 ; c. 3/8 = 1/8 + 2/8; 2 1/8 = 1 + 1 + 1/8 = 8/8 + 8/8 + 1/8. d. 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. e. Solve word problems involving addition and subtraction of fractions referring to the same	**M.O.4.1.4 using concrete models, benchmark fractions, number line** • compare and order fractions with like and unlike denominators • **add and subtract fractions with like** and unlike **denominators** • model equivalent fractions **model addition and subtraction of mixed numbers** with and without regrouping.	0	2	The NxG WV objective expects students to understand addition and subtraction of fractions and equivalent fractions. Students apply knowledge to word problems involving fractions with like denominators and mixed number situations.

whole and having like denominators, e.g., by using visual fraction models and equations to represent the problem.				
M.4.NF.4 Apply and extend previous understandings of multiplication to multiply a fraction by a whole number. 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	**M.O.6.1.4 analyze and solve real-world problems involving** addition, subtraction, **multiplication, and division of** • whole numbers, • **fractions**, mixed numbers, • decimals, • integers, and justify the reasonableness by estimation.	-2	1	The NxG WV objective focuses on building understanding of multiplying fractions by a whole number.

will be needed? Between what two whole numbers does your answer lie?				
M.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.	**M.O.4.1.4** using concrete models, benchmark fractions, number line • **compare and order fractions with like and unlike denominators** • **add** and subtract **fractions with like and unlike denominators** • **model equivalent fractions** model addition and subtraction of mixed numbers with and without regrouping.	0	2	The NxG WV objective focuses on the fraction equivalents with denominators of 10 and 100 to lay the foundation for decimals.
M.4.NF.6 Use decimal notation for fractions with denominators 10 or 100. For example, rewrite 0.62 as 62/100; describe a length as 0.62 meters; locate 0.62 on a number line diagram.	**M.O.4.1.1** read, write, order, and compare whole numbers to the millions place and decimals to thousandths place **using a variety of strategies (e.g. symbols, manipulatives, number line, pictorial representations).**	0	1	The NxG WV objective focuses on decimal notation for fractions to the 10^{th} or 100^{th} places.
	M.O.4.1.5 analyze the relationship of fractions to decimals using concrete objects and pictorial representations	0	3	The NxG WV objective extends student understanding of decimals and fractions to the number line.
M.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.	**M.O.4.1.1** read, write, order, and compare whole numbers to the millions place and **decimals** to thousandths place using a variety of strategies (e.g. symbols, manipulatives, number line, pictorial representations).	0	2	The NxG WV objective focuses on understanding of decimals to hundredths.
M.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	**M.O.4.4.1** select appropriate measuring tools, **apply and convert standard units within a system to estimate, measure, compare and order real-world measurements including:**	0	3	The NxG WV objective extends representation of equivalent measures to two column tables, which lays the foundation for functions.

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).	• **lengths using customary (to the nearest one-fourth inch) and metric units,** • **weight,** • **capacity**, • temperature, and **justify and present results.**			
M.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 number line diagrams that feature a measurement scale.	**M.O.4.4.1** select appropriate measuring tools, apply and convert standard units within a system to estimate, measure, compare and order real-world measurements including: • lengths using customary (to the nearest one-fourth inch) and metric units, • weight, • capacity, • temperature, and justify and present results.	0	2	The NxG WV objective focuses on solving problems related to measurement.
	M.O.4.4.3 read time to the minute, calculate elapsed time in hours/minutes within a 24-hour period	0	3	The NxG WV objective extends student learning into other types of measurement.
	M.O.4.4.4 given real-world situations, count coins and bills and determine correct change	0	3	The NxG WV objective extends student learning into other types of measurement.
M.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. Represent and interpret data.	**M.O.4.4.2** Quantify area by finding the total number of same sized units that cover a shape, develop a rule and justify the formula for the area of a rectangle using the area model representing multiplication.	0	2	The NxG WV objective focuses on applying the formulas for area and perimeter.

M.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.	**M.O.4.5.2** pose a grade-appropriate question that can be addressed with data, collect, organize, display, and analyze data in order to answer the question.	0	1	The NxG WV objective uses a line plot to solve addition and subtraction problems involving fractions.
M.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.	**M.O.4.3.6** draw and identify parts of a circle: center point, diameter, and radius	0	1	The NxG WV objective uses circular arcs to define angles.
M.4.MD.6 Measure angles in whole-number degrees using a protractor. Sketch angles of specified measure.	M.O. 5.3.1 classify and compare triangles by sides and angles; **measure the angles** of a triangle **using a protractor.**	-1	2	The NxG WV objective focuses on measuring angles using the protractor.
M.4.MD.7 Recognize angle measure as additive. When an	M.O. 6.3.2 use inductive reasoning with the measures of interior angles in	-2	1	The NxG WV objective focuses on angle measures as additive. Students will apply

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.	polygons and derive the formula to **determine the sum of the measures of the interior angles.**			addition and subtraction of angles to solve problems.
M.4.G.1 Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures.	M.O.4.3.3 identify, draw, label, compare and contrast, and classify • lines (intersecting, parallel, and perpendicular) • angles (acute, right, obtuse, and straight)	0	3	There is a strong alignment.
M.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.	M.O.4.3.1 identify, classify, compare and contrast two-dimensional (including quadrilateral shapes) and three-dimensional geometric figures according to attributes.	0	2	The NxG WV objective focuses on two-dimensional figures.
	M.O.4.3.3 identify, draw, label, compare and contrast, and classify • lines (intersecting, parallel, and perpendicular) • angles (acute, right, obtuse, and straight)	0	2	The NxG WV objective asks students to use their knowledge to classify objects andbuilds on M.4.G.1.
M.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	M.O.4.3.4 identify and create a two-dimensional design with one line of symmetry.	0	3	There is a strong alignment.

Fifth Grade Mathematics

How to Read the Crosswalk Document

The West Virginia Crosswalk document is designed to help readers easily understand the similarities and differences between the 21st Century Content Standards and Objectives for English Language Arts and Mathematics in WV Schools and the Next Generation WV Content Standards and Objectives for English Language Arts and Mathematics that have been aligned with the *Common Core State Standards for English Language Arts and Literacy in History/Social Studies, Science and Technical Subjects* and the *Common Core State Standards for Mathematics.*

NxG WV State Objective Aligned to CCSS	WV 21st Century Objective	Grade △	Alignment	Comment
M.5.OA.1 Use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols.	**M.O.4.2.4** solve real-world problems **involving order of operations including grouping symbols and the four operations**	+ 1	2	The NxG WV objective expects students to follow the order of operations to evaluate expressions.
M.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.*	**M.O.6.2.3** create algebraic expressions that correspond to real-world situations; use the expressions to solve problems.	- 1	2	The NxG WV objective requires analysis of expressions without doing the calculations, which requires a deeper level of understanding.

M.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 sequence are twice the corresponding terms in the other sequence. Explain informally why this is so.*	**M.O.4.3.5** graph/plot ordered pairs on a first-quadrant grid and use the coordinate system to specify location	+ 1	1	The NxG WV objective focuses on functions and relationships rather than simply plotting ordered pairs. *See M.5.G.2 for graphing ordered pairs.*
	M.O.5.2.1 use inductive reasoning to find missing elements in a variety of patterns (e.g., square numbers, arithmetic sequences).	0	1	The NxG WV objective involves graphically comparing the relationship of two different rules.
	M.O.5.2.2 given an input/output model using two operations, determine the rule, output or input.	0	2	The NxG WV objective requires students to represent two rules graphically and identify the relationship between them.
	M.O.7.2.1 use inductive reasoning to find missing elements in a variety of arithmetic and geometric patterns including algebraic sequences and series.	- 2	1	The NxG WV objective expects students to compare and graph two patterns.
	M.O.7.2.3 solve problems by creating an input/output function table (including, but not limited to, spreadsheets) to predict future values, given a real-world situation involving rational numbers.	- 2	2	The NxG WV objective expects students to compare and graph two patterns.
M.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.			0	
M.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.	**M.O.5.1.2** demonstrate an understanding of place value of each digit utilizing standard and expanded form in any whole number using powers of 10 $[(3 \times 10^5) + (4 \times 10^3) + 7 \times 10^2) + (1 \times 10^1) + 6]$.	0	2	The NxG WV objective requires students to explain patterns in the place value system when working with powers of ten.
M.5.NBT.3 Read, write, and compare decimals to thousandths. a. Read and write decimals	**M.O.5.1.1 read, write, order and compare all** whole numbers, fractions, mixed numbers and	0	2	The NxG WV objective focuses on decimal numbers and expects students to represent decimal numbers in expanded

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.	**decimals using multiple strategies (e.g., symbols, manipulatives, number line).**			form.
	M.O.5.1.2 demonstrate an understanding of place value of each digit utilizing standard and expanded form in any whole number using powers of 10 [(3 X 10^5) + (4 X 10^3) + 7 X 10^2) + (1 X 10^1) + 6]	0	2	The NxG WV objective extends students' understanding of place value with whole numbers to decimals.
M.5.NBT.4 Use place value understanding to round decimals to any place.	**M.O.4.1.6** round decimals to the nearest whole, 10th, or 100th place.	+ 1	3	There is a strong alignment.
M.5.NBT.5 Fluently multiply multi-digit whole numbers using the standard algorithm.	**M.O.4.1.8** solve multi-digit whole number multiplication problems using a variety of strategies, including the standard algorithm, justify methods used.	+ 1	2	The NxG WV objective expects students to master the standard algorithm for multiplication.
	M.O.5.1.10 demonstrate fluency in addition, subtraction, **multiplication** and division of whole numbers.	0	2	The NxG WV objective expects students to master the standard algorithm for multiplication.
M.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.	**M.O.5.1.9** solve multi-digit whole number division problems using a variety of strategies, including the standard algorithm and justify the solutions	0	3	There is a strong alignment.
	M.O.5.1.10 demonstrate fluency in addition, subtraction, multiplication and division of whole numbers.	0	1	The NxG WV objective builds understanding of the division process. Fluency with the standard algorithm for division is not expected until sixth grade.
M.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,	**M.O.5.1.10** demonstrate fluency in addition, subtraction, multiplication and division of whole numbers.	0	1	The NxG WV objective extends student understanding of operations with whole numbers to decimals.

and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used.				
M.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 + 5/4 = 8/12 + 15/12 = 23/12. (In general, a/b + c/d = (ad + bc)/bd.)*	**M.O.5.1.6 model and write equivalencies of fractions**, decimals, percents, and ratios	0	1	The NxG WV objective extends understanding of equivalent fractions to add/subtract fractions and mixed numbers with different denominators.
	M.O.5.1.7 analyze and solve application problems and justify reasonableness of solution in problems involving **addition and subtraction of:** • **fractions and mixed numbers** • decimals	0	2	The NxG WV objective concentrates on addition/subtraction of fractions and mixed numbers.
M.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.*	**M.O.5.1.7 analyze and solve application problems and justify reasonableness of solution in problems involving addition and subtraction of:** • **fractions and mixed numbers** • decimals	0	2	The NxG WV objective concentrates on solving application problems involving addition/subtraction of fractions and justifying their solutions.
	M.O.5.1.11 solve real-world problems involving whole numbers, decimals and fractions using multiple strategies and justify the reasonableness by estimation.	0	2	The NxG WV objective concentrates on solving application problems involving addition /subtraction of fractions and justifying their solutions.
M.5.NF.3 Interpret a fraction as division of the numerator by the denominator ($a/b = a \div b$). 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*		0	0	The NxG WV objective develops student understanding of fractions as division

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?				
M.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 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	**M.O.6.1.4** analyze and solve real-world problems involving addition, subtraction, multiplication and division of • whole numbers, • fractions, mixed numbers, • decimals, • integers, and justify the reasonableness by estimation.	- 1	1	The NxG WV objective builds student understanding of multiplication of fractions.

of rectangles, and represent fraction products as rectangular areas.				
M.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 $a/b = (n \times a)/(n \times b)$ to the effect of multiplying a/b by 1.	**M.O.6.1.8 demonstrate an understanding of the effect of multiplying** and dividing, **whole numbers, fractions and decimals by numbers including 0,1 and values between 0 and 1.**	-1	2	The NxG WV objective expects students to demonstrate understanding of the effect on the product when one or both factors are increased or decreased.
M.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.	**M.O.6.1.4 Analyze and solve real-world problems involving addition, subtraction, multiplication** and division of • whole numbers, • **fractions, mixed numbers,** • decimals, • and analyze justify the reasonableness by estimation.	-1	1	The NxG WV objective focuses on building student understanding of multiplying fractions and mixed numbers.
M.5.NF.7 Apply and extend previous understandings of	**M.O.6.1.4** Analyze and solve real-world problems involving addition,	-1	1	The NxG WV objective focuses on building students' conceptual understanding of

division to divide unit fractions by whole numbers and whole numbers by unit fractions.[1] [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. *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.* *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	subtraction, multiplication and **division of** • whole numbers, • **fractions**, mixed numbers, • decimals, • and analyze justify the reasonableness by estimation.			dividing fractions and mixed numbers based on their previous understanding of the relationship between multiplication and division. The focus is on division involving whole numbers and unit fractions.
	M.O.6.1.8 demonstrate an understanding of the effect of multiplying and dividing, whole numbers, fractions and decimals **by numbers including 0,1 and values between 0 and 1**.	-1	1	The NxG WV objective expects students to demonstrate conceptual understanding of division of a fraction and division of a whole number by a fraction. This builds conceptual understanding of the algorithm for division with fractions.

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 many1/3-cup servings are in 2 cups of raisins?*				
M.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.	**M.O.5.4.5** solve real-world problems requiring conversions within a system of measurement.	0	3	There is a strong alignment.
	M.O.7.4.3 convert units of measurement, linear, area and volume, within customary and metric systems.	0	3	There is a strong alignment. The NxG WV objective includes solving real-world problems.
M.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.*	**M.O.5.5.2** construct, read, and interpret tables, charts, and graphs including stem and leaf plots to draw reasonable inferences or verify predictions.	0	1	The NxG WV objective concentrates on line plots involving fractional units.
M.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	**M.O.5.4.3** develop strategies (i.e. finding number of same sized units of volume) to determine the volume of a rectangular prism; solve application problems involving estimating or measuring volume of rectangular prisms.	0	2	This NxG WV objectivelays the foundation for understanding volume.

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.				
M.5.MD.4 Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft, and improvised units.	**M.O.5.4.3 develop strategies (i.e. finding number of same sized units of volume) to determine the volume of a rectangular prism**; solve application problems involving estimating or measuring volume of rectangular prisms.	0	3	There is a strong alignment.
M.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, 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	**M.O.5.4.3** develop strategies (**i.e. finding number of same sized units of volume) to determine the volume of a rectangular prism**; **solve application problems involving estimating or measuring volume of rectangular prisms.**	0	3	There is a strong alignment.
	M.O.6.4.2 develop and test hypotheses to determine formulas for • perimeter of polygons, including composite figures • area of parallelograms • area of triangles • area of composite figures made of parallelograms and triangles • circumference of a circle • area of a circle • **volume of a rectangular prism**	- 1	1	In the NxG WV objective students develop the formula for volume of a rectangular prism.
	M.O.7.4.1 select and apply an appropriate method to solve (including, but not limited to, formulas) justify the method and the reasonableness of the solution,	-2	1	The NxG WV objective requires students to solve problems involving volume of a rectangular prism.

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.	**given a real-world problem solving situation involving** • perimeter • circumference • area • surface area of prisms (rectangular and triangular) • **volume of prisms** and cylinders • distance and temperature (Celsius, Fahrenheit)			
M.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).	**M.O.3.3.7** name the location of a point on a first-quadrant grid, represent using ordered pairs.	+2	1	The NxG WV objective gives students an overview of the entire coordinate plane.
	M.O.4.3.5 graph/plot ordered pairs on a first-quadrant grid and use the coordinate system to specify location	+1	1	The NxG WV objective gives students an overview of the entire coordinate plane.
M.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	**M.O.3.3.7** name the location of a point on a first-quadrant grid, represent using ordered pairs.	+2	2	The NxG WV objective puts this skill in a real-world context.
	M.O.4.3.5 graph/plot ordered pairs on a first-quadrant grid and use the coordinate system to specify location	+ 1	2	The NxG WV objective puts this skill in a real-world context.
M.5.G.3 Understand that attributes	**M.O.4.3.1** identify, **classify, compare**	+ 1	2	The NxG WV objective stresses that the

belonging to a category of two dimensional figures also belong to all subcategories of that category. *For example, all rectangles have four right angles and squares are rectangles, so all squares have four right angles.*	**and contrast two-dimensional (including quadrilateral shapes)** and three-dimensional geometric figures according to attributes.			attributes of two-dimensional figures allow them to be placed in multiple categories.
	M.O.5.3.1 classify and compare triangles **by sides and angles;** measure the angles of a triangle using a protractor.	0	1	The NxG WV objective requires students to think more deeply about the attributes of all two-dimensional shapes.
M.5.G.4 Classify two-dimensional figures in a hierarchy based on properties.	**M.O.4.3.1** identify, **classify, compare and contrast two-dimensional (including quadrilateral shapes)** and three-dimensional geometric figures according to attributes.	+1	2	The NxG WV CSO requires a greater depth of knowledge and focuses only on two-dimensional figures.
	M.O.5.3.1 classify and compare triangles **by sides and angles;** measure the angles of a triangle using a protractor.	0	1	The NxG WV CSO requires students to have a global understanding of two-dimensional figures
	M.O.6.3.1 analyze characteristics using defining properties of • lines, • angles, • polygons, • triangles, and compare these geometric figures.	-1	3	There is a strong alignment.

Sixth Grade Mathematics

How to Read the Crosswalk Document

The West Virginia Crosswalk document is designed to help readers easily understand the similarities and differences between the 21st Century Content Standards and Objectives for English Language Arts and Mathematics in WV Schools and the Next Generation WV Content Standards and Objectives for English Language Arts and Mathematics that have been aligned with the *Common Core State Standards for English Language Arts and Literacy in History/Social Studies, Science and Technical Subjects* and the *Common Core State Standards for Mathematics.*

NxG WV State Objective Aligned to CCSS	WV 21st Century Objective	Grade △	Alignment	Comment
M.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	**M.O.4.2.2** recognize and describe relationships in which quantities change proportionally.	+2	3	There is a strong alignment.
M.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*	**M.O.6.2.5** solve real world proportion problems involving rates, probability and measurements using multiple strategies justify selection of strategies.	0	2	The NxG WV objective is more coherent and focused.

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.				
M.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 equivalent ratios relating quantities with whole number *b.* measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios. *c.* 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?* d. Find a percent of a quantity as a rate 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	**M.O.6.2.5.** solve real world proportion problems involving rates, probability and measurements using multiple strategies justify selection of strategies.	0	2	The NxG WV objective incorporates the use of instructional models.
	M.O. 4.1.10 create grade level real world appropriate problems using multiple strategies including simple ratios, justify the reason for choosing a particular strategy and present results	+2	2	The NxG WV objective incorporates the use of instructional models.
	M.O.6.2.5. solve real world proportion problems involving rates, probability and measurements using multiple strategies justify selection of strategies.	**0**	**3**	There is a strong alignment.
	M.O.6.1.7 compute the percent of a number to solve application problems and justify the reasonableness by estimation.	**0**	**3**	There is a strong alignment.
	M.O. 6.1.6 convert between fractions/ratios, mixed numbers, decimals and percents in appropriate real world problems.	**0**	**3**	There is a strong alignment.
	M.O.6.1.7 compute the percent of a number to solve application problems and justify the reasonableness by estimation.	**0**	**3**	There is a strong alignment.
	M.O.6.4.5 given a 2 dimensional polygon, construct a scale drawing given the scale factor.	**0**	1	The NxG WV objective focuses on ratio reasoning to convert measurement units .

e. Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.				
M.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 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 ½ square mi?*	**M.O.6.1.4** analyze and solve real-world problems involving addition, subtraction, multiplication and division of • Whole numbers, • Fractions, mixed numbers, • Decimals, • Integers, and justify the reasonableness by estimation.	0	1	The NxG WV objective concentrates on fractions and mixed numbers.
M.6.NS.2 Fluently divide multi-digit numbers using the standard algorithm.	**M.O.6.1.4** analyze and solve real-world problems involving addition, subtraction, multiplication and division of • Whole numbers, • Fractions, mixed numbers, • Decimals, • Integers, and justify the reasonableness by estimation.	0	3	There is a strong alignment.

M.6.NS.3 Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation.	**M.O.6.1.4** analyze and solve real-world problems involving addition, subtraction, multiplication and division of • Whole numbers, • Fractions, mixed numbers, • Decimals, • Integers, and justify the reasonableness by estimation.	0	1	The NxG WV objective concentrates on decimals.
M.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).*	**M.O.6.1.2** determine the greatest common factor and least common multiple using multiple strategies to solve real-world; find prime factorization of a number.	0	3	There is a strong alignment.
	M.O.5.1.5 determine and apply greatest common factor and least common multiple to write equivalent fractions and to real-world problem situations.	+1	2	The NxG WV objective goes beyond procedural understanding.
M.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 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.	**M.O.6.1.3** compare and order integers using multiple strategies (e.g., symbols, manipulatives, number line).	0	3	There is a strong alignment.
M.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	**M.O.6.1.3** compare and order integers using multiple strategies (e.g., symbols, manipulatives, number line).	0	3	There is a strong alignment.

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.				
M.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*	**M.O.6.1.3** compare and order integers using multiple strategies (e.g., symbols, manipulatives, number line).	0	3	There is a strong alignment.

example, interpret –3 > –7 as a statement that –3 is located to the right of –7 on a number line oriented from left to right. *b.* Write, interpret, and explain statements of order for rational numbers in real-world contexts. *For example, write –3 oC > –7 oC to express the fact that –3 oC is warmer than –7 oC.* *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.*				
M.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	**M.O.6.3.7** plot polygons on coordinate grids, determine lengths and areas from the graphs.	0	3	There is a strong alignment.

between points with the same first coordinate or the same second coordinate.				
M.6.EE.1 Write and evaluate numerical expressions involving whole-number exponents.	**M.O.6.2.1** simplify numerical expressions and evaluate algebraic expressions using order of operations.	0	3	There is a strong alignment.
	M.O.6.2.1 simplify numerical expressions and evaluate algebraic expressions using order of operations.	0	3	There is a strong alignment.
M.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	**M.O.3.2.5** use symbol and letter variables to represent an unknown quantity and determine value of variable.	+3	3	There is a strong alignment.
	M.O.6.2.1 simplify numerical expressions and evaluate algebraic expressions using order of operations.	0	3	There is a strong alignment.
	M.O.7.2.8 represent algebraically and solve real world problems and justify solutions.	-1	3	There is a strong alignment.

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 = s3 and A = 6 s2 to find the volume and surface area of a cube with sides of length s = 1/2.*				
M.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.*	**M.O.6.1.5** Apply the distributive , commutative, associative and identity properties to numeric expressions and use to prove equivalency	**0**	**3**	There is a strong alignment.
M.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.*			**0**	
M.6.EE.5 Understand solving an equation or inequality as a process of answering a question: which values from a specified set,	**M.O. 5.2.3** solve simple equations and inequalities using patterns and models of real-world situations, create graphs on number lines of the equation and	+1	2	. The NxG WV objective goes beyond procedural understanding.

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.	interpret results.			
	M.O. 6.2.6 write and solve one step equations using number sense, properties of operations and the idea of maintaining equality to represent and solve real world problems.	0	2	The NxG WV objective requires a deeper understanding of the concept.
M.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.	**M.O. 6.2.6** write and solve one step equations using number sense, properties of operations and the idea of maintaining equality to represent and solve real world problems.	0	3	There is a strong alignment.
M.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.	**M.O. 6.2.6** write and solve one step equations using number sense, properties of operations and the idea of maintaining equality to represent and solve real world problems.	0	3	There is a strong alignment.
M.6.EE.8 Write an inequality of the form $x > c$ or $x < c$ to 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; represent solutions of such inequalities on number line diagrams.			0	
M.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			0	

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.*				
M.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.	**M.O.6.4.2** develop and test hypotheses to determine formulas for • Perimeter of polygons, including composite figures • Area of parallelograms • Area of triangles • Area of composite figures made of parallelograms and triangles • Circumference of a circle • Area of a circle • Volume of a rectangular prism.	0	3	There is a strong alignment.
	M.O.5.4.2 model, calculate and compare area of triangles and parallelograms using multiple strategies (including, but not limited to formulas).	+1	3	There is a strong alignment.
M.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	**M.O.6.4.2** develop and test hypotheses to determine formulas for • Perimeter of polygons, including composite figures • Area of parallelograms • Area of triangles • Area of composite figures made of parallelograms and triangles • Circumference of a circle • Area of a circle • Volume of a rectangular prism.	0	1	The NxG WV objective concentrates on volume.

solving real-world and mathematical problems.				
M.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.	**M.O.6.3.6** use geometric representations to solve real-world problems.	0	3	There is a strong alignment.
M.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.	**M.O.6.3.6** use geometric representations to solve real-world problems.	0	3	There is a strong alignment.
	M.O.6.4.3 investigate, model and describe surface area of rectangular prisms and cylinders; develop strategies to determine the surface area of rectangular prisms.	0	3	There is a strong alignment.
	M.O.5.3.2 construct and analyze three-dimensional shapes using properties (i.e. edges, faces or vertices).	+1	2	The NxG WV objective requires application of the concept of surface area.
M.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.*	**M.O.4.5.2** pose a grade appropriate question.	+2	3	There is a strong alignment.
	M.O.6.5.1 collect, organize, display read, interpret and analyze real world data using appropriate graphs and tables (w and w/o technology).	0	1	The NxG WV objective focuses on a statistical question.
	M.O.6.5.2 Identify a real life situation using statistical measures (mean, median, mode, range and outliers) overtime, make a hypothesis as to the outcome design and implement a method to collect, organize, and analyze data; analyze the results to make a conclusion; evaluate the validity of the hypothesis based on collected data design a mode of	0	1	The NxG WV objective focuses on statistics.

	presentation using words, graphs, models and/or tables (w and w/o technology).			
M.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.	**M.O.6.5.1** collect, organize, display read, interpret and analyze real world data using appropriate graphs and tables (w and w/o technology).	0	1	The NxG WV objective focuses on statistics.
	M.O.6.5.2 Identify a real life situation using statistical measures (mean, median, mode, range and outliers) overtime, make a hypothesis as to the outcome design and implement a method to collect, organize, and analyze data; analyze the results to make a conclusion; evaluate the validity of the hypothesis based on collected data design a mode of presentation using words, graphs, models and/or tables (w and w/o technology).	0	2	The NxG WV objective focuses on a single concept of statistics.
M.6.SP.3 Recognize that a measure of center for a numerical data set summarizes all of its values with a single number, while a measure of variation describes how its values vary with a single number.	**M.O.4.5.4** solve real world problems using mean median and mode.	+2	3	There is a strong alignment.
	M.O. 5.5.4 collect and analyze data using mean, median and mode to determine best statistical measure.	+1	3	There is a strong alignment.
	M.O.6.5.1 collect, organize, display read, interpret and analyze real world data using appropriate graphs and tables (w and w/o technology).	0	1	The NxG WV objective focuses on the concept of statistics.
	M.O.6.5.2 Identify a real life situation using statistical measures (mean, median, mode, range and outliers) overtime, make a hypothesis as to the outcome design and implement a method to collect, organize, and analyze data; analyze the results to make a conclusion; evaluate the validity of the hypothesis based on collected data design a mode of presentation using words, graphs,	0	2	The NxG WV objective focuses on a single concept of statistics.

	models and/or tables (w and w/o technology).			
M.6.SP.4 Display numerical data in plots on a number line, including dot plots, histograms, and box plots.	**M.O.6.5.1** collect, organize, display read, interpret and analyze real world data using appropriate graphs and tables (w and w/o technology)**.**	0	3	There is a strong alignment.
	M.O.7.5.3 collect organize graphically represent and interpret data displays including frequency distributions, line plots, scatter plots, box and multiple line graphs.	-1	3	There is a strong alignment.
	M.O.8.5.3 create and extrapolate information from multiple graphs, box and whisker plots and other data displays using appropriate technology.	-2	1	The NxG WV objective focuses on the display of data.
M.6.SP.5 Summarize numerical data sets in relation to their 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	**M.O.7.5.4** analyze and solve application problems involving measure of central tendency and dispersion from data, graphs, tables and experiments using appropriate technology to compare 2 sets of data.	-1	2	The NxG WV objective requires students to communicate their understanding while making sense of the procedure.

variability to the shape of the data distribution and the context in which the data were gathered.				

Seventh Grade Mathematics

How to Read the Crosswalk Document

The West Virginia Crosswalk document is designed to help readers easily understand the similarities and differences between the 21st Century Content Standards and Objectives for English Language Arts and Mathematics in WV Schools and the Next Generation WV Content Standards and Objectives for English Language Arts and Mathematics that have been aligned with the *Common Core State Standards for English Language Arts and Literacy in History/Social Studies, Science and Technical Subjects* and the *Common Core State Standards for Mathematics.*

NxG WV State Objective Aligned to CCSS	WV 21st Century Objective	Grade △	Alignment	Comment
M.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.*	**M.O.7.2.4** analyze proportional relationships in real-world situations, select an appropriate method to determine the solution and justify reasoning for choice of method to solve.	0	2	The NxG WV objective has deeper expectations for students regarding ratios of fractions.
M.7.RP.2 Recognize and represent proportional relationships between quantities. a. Decide whether two quantities are in a	**M.O.8.1.3** analyze and solve grade-appropriate real-world problems with • whole numbers, • decimals, • fractions,	-1	2	The NxG WV objective has deeper expectations regarding proportional relationships visually and verbally.

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. 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.	• percents, percent increase and decrease, • integers, and including, but not limited to, rates, tips, discounts, sales tax and interest and verify solutions using estimation techniques.			
	M.O.4.2.2 recognize and describe relationships in which quantities change proportionally.	+3	2	The NxG WV objective incorporates deeper expectations regarding visual relationships.
	M.O.8.3.5 create scale models of similar figures using ratio, proportion with pencil/paper and technology and determine scale factor.	-1	2	The NxG WV objective addresses incorporates deeper expectations regarding visual relationships.
	M.O.7.2.9 identify a real life problem involving proportionality; make a hypothesis as to the outcome; develop, justify, and implement a method to collect, organize, and analyze data; generalize the results to make a conclusion; compare the hypothesis and the conclusion; present the project using words, graphs, drawings, models, or tables.	0	3	There is a strong alignment.
	M.O.7.2.6 plot lines within the Cartesian coordinate plane from a table of values to solve mathematical real-world problems.	0	1	The NxG WV includes a broader approach regarding unit rates.
	M.O.8.1.3 analyze and solve grade-appropriate real-world problems with • whole numbers, • decimals, • fractions, • percents, percent increase and decrease, • integers, and	-1	1	The NxG WV objective requires students to communicate proportional relationships visually and verbally.

	including, but not limited to, rates, tips, discounts, sales tax and interest and verify solutions using estimation techniques.			
M.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.*	**M.O.8.1.3** analyze and solve grade-appropriate real-world problems with • whole numbers, • decimals, • fractions, • percents, percent increase and decrease, • integers, and including, but not limited to, rates, tips, discounts, sales tax and interest and verify solutions using estimation techniques.	-1	3	The NxG WV objective provides a broader approach to the concept of proportional relationships.
M.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 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 $\|q\|$ from p, in the positive or negative direction depending on whether q is	**M.O.7.1.1** compare, order, and differentiate among integers, decimals, fractions, and irrational numbers using multiple representations (e.g., symbols, manipulatives, graphing on a number line).	0	2	The NxG WV objective provides a broader approach to the concept of additive inverse and absolute value.
	M.O.6.1.9 develop and test hypotheses to derive the rules for addition, subtraction, multiplication and division of integers, justify by using real-world examples and use them to solve problems.	+1	3	The NxG WV objective provides a broader approach to the concept of additive inverse and absolute value.
	M.O.7.1.3 using simple computation and problem-solving situations, demonstrate fluency and justify solutions in performing operations with rational numbers including negative numbers for • adding	0	3	The NxG WV objective provides a broader approach to the concept of additive inverse and absolute value.

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 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. d. Apply properties of operations as strategies to add and subtract rational numbers.	• subtracting • multiplying • dividing.			
	M.O.7.1.4 justify the use of the commutative, associative, distributive and inverse properties to simplify numeric expressions.	0	1	The NxG WV objective focuses on the binary operations of rational numbers using inverses.
M.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	**M.O.6.1.9** develop and test hypotheses to derive the rules for addition, subtraction, multiplication and division of integers, justify by using real-world examples and use them to solve problems.	+1	3	The NxG WV objective provides a broader approach to the concept of multiplicative inverse.
	M.O.7.1.3 using simple computation and problem-solving situations, demonstrate fluency and justify solutions in performing operations with rational numbers including negative numbers for • adding • subtracting	0	3	The NxG WV objective provides a broader approach to the concept of multiplicative inverse.

to products such as (–1)(–1) = 1 and the rules for multiplying signed numbers. Interpret products of rational numbers by describing real-world contexts b. Understand that integers can be divided, provided that the divisor is not zero, and every quotient of integers (with non-zero divisor) is a rational number. If *p* and *q* are integers, then – (*p*/*q*) = (–*p*)/*q* =*p*/ (–*q*). Interpret quotients of rational numbers by describing real world contexts. c. Apply properties of operations as strategies to multiply and divide rational numbers. a. 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.	• multiplying • dividing.			
M.7.NS.3. Solve real-world and mathematical problems involving the four operations with rational numbers. (Computations with rational numbers extend the rules for manipulating fractions to complex fractions.)	**M.O.7.1.3** using simple computation and problem-solving situations, demonstrate fluency and justify solutions in performing operations with rational numbers including negative numbers for • adding • subtracting • multiplying	0	3	There is a strong alignment.

	• dividing.			
	M.O.8.1.3 analyze and solve grade-appropriate real-world problems with • whole numbers, • decimals, • fractions, • percents, percent increase and decrease, • integers, and including, but not limited to, rates, tips, discounts, sales tax and interest and verify solutions using estimation techniques.	-1	3	There is a strong alignment.
M.7.EE.1. Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.			0	
M.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."*	**M.O.7.2.2** evaluate algebraic expressions with whole numbers, integers, absolute value and exponents using the order of operations.	0	2	The NxG WV objective provides a deeper approach to the concept of algebraic expressions.
M.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	**M.O.7.1.5** analyze and solve grade-appropriate real-world problems with whole numbers, integers, decimals, fractions and percents including problems involving • discounts, • interest, • taxes, • tips, • percent increase or decrease, and	0	3	There is a strong alignment.

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.*	justify solutions including using estimation and reasonableness.			
M.7.EE.4. Use variables to represent quantities in a real-world or mathematical problem, and construct simple 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?*	**M.O.A1.2.1** formulate algebraic expressions for use in equations and inequalities that require planning to accurately model real-world problems.	-2	3	There is a strong alignment.

b. 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.*				
M.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.	**M.O.7.3.4** pose and solve ratio and proportion problems including scale drawings and similar polygons.	0	3	There is a strong alignment.
	M.O.7.3.5 solve mathematical real-world problems using compound geometric figures.	0	1	The NxG WV objective focuses on scale drawings.
	M.O.8.3.5 create scale models of similar figures using ratio, proportion with pencil/paper and technology and determine scale factor.	-1	3	There is a strong alignment.
M.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	**M.O.G.3.10** investigate measures of angles and lengths of segments to determine the existence of a triangle (triangle inequality) and to establish the relationship between the measures of the angles and the length of the sides (with and without technology).	-3	3	There is a strong alignment.

than one triangle, or no triangle.				
M.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.	**M.O.8.3.6** make and test a conjecture concerning • regular polygons, • the cross section of a solid such as a cylinder, cone, and pyramid, • the intersection of two or more geometric figures in the plane (e.g., intersection of a circle and a line), and justify the results.	-1	3	There is a strong alignment.
M.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.	**M.O.6.4.1** determine an approximation for pi using actual measurements.	+1	3	There is a strong alignment.
	M.O.7.4.1 select and apply an appropriate method to solve (including, but not limited to, formulas) justify the method and the reasonableness of the solution, given a real-world problem solving situation involving. perimeter • circumference • area • surface area of prisms (rectangular and triangular) • volume of prisms and cylinders distance and temperature (Celsius, Fahrenheit).	0	2	The NxG WV objective provides a deeper approach to the concept of circles.
M.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.	**M.O.7.3.1** identify and construct • angle-pairs adjacent, complementary, supplementary, vertical • congruent segments and angles • perpendicular bisectors of segments angle-bisectors.	0	2	The NxG WV objective requires a deeper understanding of the concept of angles to solve equations.
M.7.G.6. Solve real-world and	**M.O.7.3.6** solve mathematical real-	0	3	The NxG WV objective is more specific

mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.	world problems using compound geometric figures.			regarding types of geometric figures.
	M.O.7.4.1 select and apply an appropriate method to solve (including, but not limited to, formulas) justify the method and the reasonableness of the solution, given a real-world problem solving situation involving • perimeter • circumference • area • surface area of prisms (rectangular and triangular) • volume of prisms and cylinders • distance and temperature (Celsius, Fahrenheit).	0	1	The NxG WV objective emphasizes area and volume.
M.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.			0	
M.7.SP.2. Use data from a random sample to draw inferences about a population with an unknown characteristic of interest. Generate multiple samples (or simulated samples) of the same size to gauge the variation in estimates or			0	

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.*				
M.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 a 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.*			0	
M.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 examples,* 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			0	

book.				
M.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, and a probability near 1 indicates a likely event.	**M.O.6.5.3** perform simple probability events using manipulatives; predict the outcome given events using experimental and theoretical probability; express experimental and theoretical probability as a ratio, decimal or percent.	+1	2	The NxG WV objective provides extensive opportunities for in-depth understanding regarding reasonableness.
M.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.*	**M.O.8.5.2** compare the experimental and theoretical probability of a given situation (including compound probability of a dependent and independent event).	-1	3	There is a strong alignment.
M.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	**M.O.8.5.4** analyze problem situations, games of chance, and consumer applications using random and non-random samplings to determine probability, make predictions, and identify sources of bias.	-1	2	The NxG WV objective provides extensive opportunities for in-depth understanding specifically regarding the probability model.

assigning equal probability to all outcomes, and use the model to determine probabilities of events. *For example, if a student is selected 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?*				
M.7.SP.8. Find probabilities of compound events using 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	**M.O.4.5.3** design and conduct a simple probability experiment using concrete objects, examine and list all possible combinations using a tree diagram, represent the outcomes as a ratio and present the results.	+3	1	The NxG WV objective addresses compound probability.
	M.O.8.5.2 compare the experimental and theoretical probability of a given situation (including compound probability of a dependent and	-1	3	There is a strong alignment.

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 4 donors to find one with type A blood?*	independent event).			
	M.O.5.5.1 construct a sample space and make a hypothesis as to the probability of a real life situation overtime, test the prediction with experimentation, and present conclusions (with and without technology).	+2	3	There is a strong alignment.
	M.O.7.5.1 determine theoretical probability of an event, make and test predictions through experimentation determine theoretical probability of an event, make and test predictions through experimentation.	0	2	The NxG WV objective develops an in-depth understanding of compound events.
	M.O.7.5.2 determine combinations and permutations by constructing sample spaces (e.g., listing, tree diagrams, frequency distribution tables).	0	1	The NxG WV objective develops an in-depth understanding of compound events.

Eighth Grade Mathematics

How to Read the Crosswalk Document

The West Virginia Crosswalk document is designed to help readers easily understand the similarities and differences between the 21st Century Content Standards and Objectives for English Language Arts and Mathematics in WV Schools and the NxG WV Objective WV Content Standards and Objectives for English Language Arts and Mathematics that have been aligned with the Common Core State Standards for English Language Arts and Literacy in History/Social Studies, Science and Technical Subjects and the Common Core State Standards for Mathematics.

NxG WV State Objective Aligned to CCSS	WV 21st Century Objective	Grade △	Alignment	Comment
M.8.NS.1 Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number.	**M.O.8.1.1** analyze, describe and compare the characteristics of rational and irrational numbers.	0	2	The NxG WV objective emphasizes the characteristics of rational numbers.
M.8.NS.2 Use rational approximations of irrational numbers to compare the size of	**M.O.8.1.1** analyze, describe and compare the characteristics of rational and irrational numbers.	0	2	The NxG WV objective requires students locate irrationals in relation to rational numbers.

irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., π2). 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 g.et better approximations.	**M.O.8.1.2** analyze and solve application problems with • powers, • squares, • square roots, • scientific notation, and verify solutions using estimation techniques.	0	1	The NxG WV objective focuses ion finding approximations of square roots.
M.8.EE.1 Know and apply the properties of integer exponents to generate equivalent numerical expressions. For example, $3^2 \times 3^{-5} = 3^{-3} = 1/3^3 = 1/27$.	**M.O.7.1.6** use inductive reasoning to find and justify the laws of exponents with numeric bases.	+1	3	There is a strong alignment
	M.O.A1.2.4 develop and test hypotheses to derive the laws of exponents and use them to perform operations on expressions with integral exponents.	-1	3	There is a strong alignment
M.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.	**M.O.7.1.2** model the relationship between perfect squares and square roots using physical representations; estimate square root and evaluate using technology.	+1	1	The NxG WV objective goes beyond modeling, addresses cube roots, and recognizes irrational numbers as possible solutions to equations.
	M.O.8.1.1analyze, describe and compare the characteristics of rational and irrational numbers.	0	1	The NxG WV objective requires students to apply and understand irrational numbers.
	M.O.8.1.2 analyze and solve application problems with • powers, • squares, • square roots, • scientific notation, and verify solutions using estimation techniques.	0	2	The NxG WV objective addresses cube roots.

M.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.	**M.O.8.1.2** analyze and solve application problems with • powers, • squares, • square roots, • scientific notation, and verify solutions using estimation techniques.	0	2	The NxG WV objective expects students to understand the magnitude of the differences in scientific notation.
M.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.	**M.O.7.1.7** solve problems using numbers in scientific notation (positive and negative exponents) with and without technology, and interpret from real life contexts.	+1	3	There is a strong alignment.
	M.O.8.1.2 analyze and solve application problems with • powers, • squares, • square roots, • scientific notation, and verify solutions using estimation techniques.	0	2	NxG WV objective focuses on understanding scientific notation.
M.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.	**M.O.7.2.7** determine the slope of a line from its graphical representation.	+1	1	The NxG WV objective develops an understanding of slope and connects slope to the real world.
	M.O.8.2.2 identify proportional relationships in real-world situations, then find and select an appropriate method to determine the solution; justify the reasonableness of the solution.	0	1	The NxG WV objective focuses on graphing and interpreting slope and making comparisons.
	M.O.8.2.8 determine the slope of a line using a variety of methods including • graphing • change in y over change in x • equation.	0	1	The NxG WV objective addresses the relationship between proportions and slope.

	M.O.8.2.10 identify a real life problem involving change over time; make a hypothesis as to the outcome; develop, justify, and implement a method to collect, organize, and analyze data; generalize the results to make a conclusion; compare the hypothesis and the results of the investigation; present the project using words, graphs, drawings, models, or tables.	0	1	The connection to the proportional nature of slope and unit rate is the focus of the NxG WV objective.
	A.1.2.6 determine the slope of a line through a variety of strategies (e.g. given an equation or graph).	-1	1	The NxG WV objective develops an understanding of slope and connects slope to the real world.
M.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.	**A.1.2.6** determine the slope of a line through a variety of strategies (e.g. given an equation or graph).	-1	1	The NxG WV objective uses similar triangles to develop an understanding of slope.
M.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. b. Solve linear equations with rational number coefficients, including	**M.O.8.2.1** use a variety of strategies to solve one and two-step linear equations and inequalities with rational solutions; defend the selection of the strategy; graph the solutions and justify the reasonableness of the solution.	0	2	The NxG WV objective provides specific examples of linear equations.

equations whose solutions require expanding expressions using the distributive property and collecting like terms.				
M.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. c. 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.	**M.O.8.2.4** use systems of linear equations to analyze situations and solve problems.	0	3	The NxG WV objective requires greater depth of understanding.

M.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] (function notation not required in grade 8.)	**M.O.6.2.4** determine the rule, output or input; given an input/output model using one operation, write an algebraic expression for the rule and use to identify other input/output values.	+2	3	There is a strong alignment
	M.O.8.2.5- apply inductive and deductive reasoning to write a rule from data in an input/output table, analyze the table and the rule to determine if a functional relationship exists.	0	3	There is a strong alignment
	M.O8.2.6- graph linear equations and inequalities within the Cartesian coordinate plane by generating a table of values (with and without technology).	0	1	The NxG WV objective requires greater depth of understanding.
M.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.	**M.O.8.2.10**- identify a real life problem involving change over time; make a hypothesis as to the outcome; develop, justify, and implement a method to collect, organize, and analyze data; generalize the results to make a conclusion; compare the hypothesis and the results of the investigation; present the project using words, graphs, drawings, models, or tables.	0	1	The NxG WV objective requires greater depth of understanding.
M.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.			0	

M.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.	**M.O.8.2.10** -identify a real life problem involving change over time; make a hypothesis as to the outcome; develop, justify, and implement a method to collect, organize, and analyze data; generalize the results to make a conclusion; compare the hypothesis and the results of the investigation; present the project using words, graphs, drawings, models, or tables.	0	3	The NxG WV objective is specific about what needs to be interpreted from a graph of a real world problem.
	M.O.A1.2.21-use multiple representations, such as words, graphs, tables of values and equations, to solve practical problems; describe advantages and disadvantages of the use of each representation.	-1	1	The NxG WV objective focuses on linear relationships.
M.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.			0	
M.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. c. Parallel lines are taken to parallel lines.	**M.O.4.3.7** select, analyze and justify appropriate use of transformations (translations, rotations, flips) to solve geometric problems including congruency and tiling (tessellations).	+4	3	The NxG WV objective requires students to verify properties of rotations.
	M.O.6.3.5 predict, describe, and perform transformations on two-dimensional shapes • translations • rotations • reflections.	+2	3	The NxG WV objective focuses on verifying the properties.

	M.O.7.3.3 apply rotations, reflections, translations to plane figures and determine the coordinates of its transformation and compare and contrast the new figure with the original.	+1	3	There is a strong alignment
M.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.	**M.O.6.3.5** predict, describe, and perform transformations on two-dimensional shapes • translations • rotations • reflections.	+2	2	The NxG WV objective specifies how the transformations can be used to prove congruency.
M.8.G.3 Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.	**M.O.7.3.3** apply rotations, reflections, translations to plane figures and determine the coordinates of its transformation and compare and contrast the new figure with the original.	+1	3	The NxG WV objective extends to include dilations.
M.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.	**M.O.8.3.4 c**reate geometric patterns including tiling, art design, tessellations and scaling using transformations (rotations, reflections, translations) and predict results of combining, subdividing, and changing shapes of plane figures and solids.	0	1	The NxG WV objective asks for a sequence and understanding of similarity..
M.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.	**M.O.8.3.1** justify the relationships among corresponding, alternate interior, alternate exterior and vertical angles when parallel lines are cut by a transversal using models, pencil/paper, graphing calculator, and technology.	0	1	The NxG WV objective contains several new concepts i.e. angle sum of triangles and angle-angle similarity.

M.8.G.6 Explain a proof of the Pythagorean Theorem and its converse.	**M.O.7.4.2** use the Pythagorean Theorem to find the length of any side of a right triangle and apply to problem solving situations.	+1	1	The NxG WV objective extends student understanding of the Pythagorean Theorem.
M.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.	**M.O.7.4.2** use the Pythagorean Theorem to find the length of any side of a right triangle and apply to problem solving situations.	+1	3	There is a strong alignment
	M.O.8.4.3solve right triangle problems where the existence of triangles is not obvious using the Pythagorean Theorem and indirect measurement in real-world problem solving situations**.**	0	3	There is a strong alignment
M.8.G.8 Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.	**M.O.7.4.2** use the Pythagorean Theorem to find the length of any side of a right triangle and apply to problem solving situations.	+1	2	The NxG WV objective applies the Pythagorean Theorem to the coordinate system.
	M.O.8.4.3solve right triangle problems where the existence of triangles is not obvious using the Pythagorean Theorem and indirect measurement in real-world problem solving situations**.**	0	2	The NxG WV objective applies the Pythagorean Theorem to the coordinate system.
M.8.G.9 Know the formulas for the volumes of cone, cylinders and spheres and use them to solve real-world and mathematical problems.	**M.O. 8.4.1**select and apply an appropriate method to solve; justify the method and the reasonableness of the solution of problems involving volume of • prisms • cylinders • cones • pyramids • spheres given real-world problem solving situations.	0	3	There is a strong alignment
	M.O.8.4.2solve problems involving missing measurements in plane and solid geometric figures using formulas and drawings including irregular figures, models or definitions.	0	2	The NxG WV objective focuses on volume.

	M.O.6.4.4 develop strategies to determine volume of cylinders; solve real-world problems involving volume of cylinders, justify the results.	+2	2	The NxG WV objective encompasses cylinders, cones, and spheres.
M.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.	**M.O.8.5.3** create and extrapolate information from multiple bar graphs, box and whisker plots, and other data displays using appropriate technology.	0	1	The NxG WV Objective focuses on bivariate scatter plots.
M.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.			0	
M.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.	**M.O. 8.2.10** identify a real life problem involving change over time; make a hypothesis as to the outcome; develop, justify, and implement a method to collect, organize, and analyze data; generalize the results to make a conclusion; compare the hypothesis and the results of the investigation; present the project using words, graphs, drawings, models, or tables.	0	1	The NxG WV objective is specific to linear models and bivariate scatter plots.

M.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?	**M.O.8.5.3 create** and extrapolate information from multiple bar graphs, box and whisker plots, and other data displays using appropriate technology.	0	2	The NxG WV objective is more specific about the types of data and displays to be created and interpreted.

High School Mathematics--Math 1

How to Read the Crosswalk Document

The West Virginia Crosswalk document is designed to help readers easily understand the similarities and differences between the 21st Century Content Standards and Objectives for English Language Arts and Mathematics in WV Schools and the Next Generation WV Content Standards and Objectives for English Language Arts and Mathematics that have been aligned with the *Common Core State Standards for English Language Arts and Literacy in History/Social Studies, Science and Technical Subjects* and the *Common Core State Standards for Mathematics.*

NxG WV State Objective Aligned to CCSS	WV 21st Century Objective	Grade △	Alignment	Comment
M.1HS.RBQ.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.			0	The NxG WV objective stresses unit analysis.
M.1HS.RBQ.2 Define **appropriate quantities** for the purpose of **descriptive modeling**.	**M.O.A1.2.2** create and solve multi-step linear equations, absolute value equations, and linear inequalities in one variable, (with and without technology); apply skills toward solving practical problems such as distance, mixtures or motion and **judge the reasonableness of solutions**.	0	1	The NxG objective requires analyzing the problem situation, as well as judging the reasonableness of the solution.

M.1HS.RBQ.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.			0	The NxG WV objective stresses appropriate levels of accuracy.
M.1HS.RBQ.4 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. (Limit to linear expressions and to exponential expressions with integer exponents.*	**M.O.A1.2.1** formulate **algebraic expressions** for use in equations and inequalities **that** require planning to accurately **model real-world problems**.	0	1	The NxG WV objective stresses interpreting elements of given expressions.
M.1HS.RBQ.5 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. (*Limit to **linear** and exponential equations, and, **in the case of exponential equations, limit to situations requiring evaluation of exponential functions at integer inputs.)***	**M.O.A1.2.2 create and solve multi-step linear equations**, absolute value equations, and **linear inequalities in one variable,** (with and without technology); **apply skills toward solving practical problems** such as distance, mixtures or motion and judge the reasonableness of solutions.	0	2	The NxG WV objective includes exponential functions; however the alignment concerning linear functions is strong.
	M.O.A1.2.15 describe real life situations involving exponential growth and decay equations including $y=2^x$ and $y=(½)^x$; compare the equation with attributes of an associated table and graph to demonstrate an understanding of their interrelationship.	0	1	The NxG WV objective is open-ended in addressing exponential functions.
M.1HS.RBQ.6 Create equations	**M.O.A1.2.5 analyze a given set of**	0	1	The NxG WV objective requires students

in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. (*Limit to linear and exponential equations, and, in the case of exponential equations, limit to situations requiring evaluation of exponential functions at integer inputs.)*	**data and prove the existence of a pattern numerically, algebraically and graphically, write equations from the patterns** and make inferences and predictions based on observing the pattern.			to create and graph linear and exponential equations.
M.1HS.RBQ.7 Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods. (Limit to linear equations and inequalities.)*	**M.O.A2.2.10** solve and graph the solution set of systems of linear inequalities in two variables by finding the maximum or minimum values of a function over the feasible region using linear programming techniques.	-2	3	There is a strong alignment.
M.1HS.RBQ.8 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. (Limit to formulas with a linear focus.)*	**M.O.A1.2.3** evaluate data provided, given a real-world situation, select an appropriate literal equation and solve for a needed variable.	0	3	There is a strong alignment.
M.1HS.LER.1 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). *(Focus on **linear** and exponential equations and be able to adapt and apply that learning to other types of equations in future courses.)*	**M.O.8.2.6 graph linear equations and inequalities within the Cartesian coordinate plane by generating a table of values (with and without technology).**	1	1	The NxG WV objective includes exponential functions and emphasizes the concept of the solution.

M.1HS.LER.2 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.* *(Focus on cases where f(x) and g(x) are linear or exponential.)*	**M.O.A1.2.9** create and **solve systems of linear equations graphically** and numerically using the elimination method and the substitution method, given a real-world situation.	0	1	The NxG WV objective includes exponential functions; its focus is on solving systems by using tables and graphs.
M.1HS.LER.3 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.**	**M.O.8.2.6 graph linear equations and inequalities within the Cartesian coordinate plane by generating a table of values (with and without technology).**	1	2	The NxG WV objective requires students to solve systems of linear inequalities by graphing.
	M.O.A2.2.10 solve and graph the solution set of systems of linear inequalities in two variables by finding the maximum or minimum values of a function over the feasible region using linear programming techniques.	-2	1	The NxG WV objective requires students to solve systems of linear inequalities by graphing.
M.1HS.LER.4 Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If *f* is a function and *x* is an element of its domain, then *f(x)* denotes the output of *f* corresponding to the input *x*. The graph of *f* is the graph of the	**M.O.A2.2.7 define a function** and find its zeros; **express the domain and range** using interval notation; find the inverse of a function; find the value of a function for a given element in its domain; and perform basic operations on functions including composition of functions.	-2	1	The NxG WV objective stresses the meaning of function.

equation $y = f(x)$.				
M.1HS.LER.5 Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.	**M.O.A2.2.7** define a function and find its zeros; express the domain and range using interval notation; find the inverse of a function; **find the value of a function for a given element in its domain;** and perform basic operations on functions including composition of functions.	-2	1	The NxG WV objective develops the meaning of function in a contextual situation.
M.1HS.LER.6 Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. *For example, the Fibonacci sequence is defined recursively by f (0) = f (1) = 1, f (n+1) = f (n) + f (n-1) for n ≥ 1.*	**M.O.A2.2.16 describe and illustrate how patterns and sequences are used to develop recursive** and closed form **equations;** analyze and describe characteristics of each form.	-2	2	The NxG WV objective stresses recursive functions.
M.1HS.LER.7 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.** (*Focus on linear and exponential functions.)*			0	The NxG WV objective stresses identifying key features of a function.
M.1HS.LER.8 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the*			0	The NxG WV objective stresses the relationship of the domain to its graph.

*positive integers would be an appropriate domain for the function.**(*Focus on linear and exponential functions.)*				
M.1HS.LER.9 Calculate and interpret **the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.***(***Focus on linear functions** *and intervals for exponential functions whose domain is a subset of the integers. Mathematics II and III will address other function types. M2.ENS.1 and M2.ENS.2 will need to be referenced here before discussing exponential models with continuous domains.)*	**M.O.A1.2.6determine the slope of a line through a variety of strategies (e.g. given an equation or graph).**	0	1	The NxG WV objective includes exponential functions and stresses understanding slope as the average rate of change.
M.1HS.LER.10 Graph functions expressed symbolically and show key features of the graph, **by hand in simple cases and using technology for more complicated cases*.** a. **Graph linear** and quadratic functions and show intercepts, maxima, and minima. e. **Graph exponential** and logarithmic functions, **showing intercepts** and end behavior, and trigonometric functions, showing period, midline, and amplitude.	**M.O.8.2.6 graph linear equations** and inequalities **within the Cartesian coordinate plane by generating a table of values (with and without technology).**	1	1	The NxG WV objective includes exponential functions and s key features.
	M.O.A1.2.15 describe real life situations involving exponential growth and decay equations including $y=2^x$ and $y=(½)^x$; **compare the equation with attributes of an associated table and graph** to demonstrate an understanding of their interrelationship.	0	1	The NxG WV objective requires student to graph and show key features of an equation and associated table.
M.1HS.LER.11 Compare properties of two functions each represented in a different	**M.O.A1.2.21 use multiple representations, such as words, graphs, tables of values and**	0	1	The NxG WV objective requires students to analyze properties of two functions represented in different ways.

way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.*	**equations,** to solve practical problems; **describe advantages and disadvantages of the use of each representation.**			
M.1HS.LER.12 Write a function that describes a relationship between two quantities.* a. **Determine an explicit expression**, a recursive process, or steps for calculation **from a context.** *b.* Combine standard function types using arithmetic operations. *For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.*	**M.O.A1.2.1 formulate algebraic expressions for use in equations** and inequalities **that require planning to accurately model real-world problems.**	0	2	There is an alignment between part a of the NxG WV objective and the 21C WV objective.
	M.O.A2.2.16 describe and illustrate how patterns and sequences are used to develop recursive and closed form **equations; analyze and describe characteristics of each form.**	-2	1	There is an alignment between part a of the NxG WV objective and the 21C WV objective.
M.1HS.LER.13 Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.* (*Connect arithmetic sequences to linear functions and geometric sequences to exponential functions.)*	**M.O.8.2.7 formulate and apply a rule to generate an arithmetic, geometric and algebraic pattern.**	1	1	The NxG WV objective emphasizes connections between sequences and functions.
M.1HS.LER.14 Identify the effect on the graph of replacing *f(x)* by *f(x) + k, k f(x), f(kx),* and *f(x + k)*	**M.O.A2.2.8 analyze families of functions and their transformations;** recognize linear,	-2	2	The NxG WV objective stresses functions and their transformations.

for specific values of *k* (both positive and negative); find the value of *k* given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. *Include recognizing even and odd functions from their graphs and algebraic expressions for them.*	quadratic, radical, absolute value, step, piece-wise, and exponential functions; analyze connections among words, graphs, tables and equations when solving practical problems with and without technology.			
M.1HS.LER.15 Distinguish between situations that can be modeled with linear functions and with exponential functions. a. Prove that linear functions grow by equal differences over equal intervals; exponential functions grow by equal factors over equal intervals. **b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.** c. c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.	**M.O.A1.2.7 analyze situations and solve problems by determining the equation of a line given a graph of a line,** two points on the line, the slope and a point, or the slope and y intercept.	0	1	There is an alignment between part b of the NxG WV objective and the 21C WV objective.
M.1HS.LER.15 Distinguish between situations that can be modeled with linear functions and with exponential functions. a. Prove that linear functions grow by equal differences over equal intervals; exponential functions grow by equal factors over equal intervals.	**M.O.A1.2.15 describe real life situations involving exponential growth and decay equations** including $y=2^x$ and $y=(\frac{1}{2})^x$; compare the equation with attributes of an associated table and graph to demonstrate an understanding of their interrelationship.	0	1	There is an alignment between part c of the NxG WV objective and the 21C WV objective.
	M.O.A2.2.8 analyze families of functions and their transformations;	-2	2	The NxG WV objective stresses comparisons between function families.

b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. c. c. **Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.**	**recognize linear,** quadratic, radical, absolute value, step, piece-wise, **and exponential functions; analyze connections among words, graphs, tables and equations when solving practical problems with and without technology.**			
M.1HS.LER.16 Construct linear and exponential **functions,** including arithmetic and geometric sequences, **given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).**	**M.O.A1.2.7** analyze situations and solve problems by **determining the equation of a line given a graph of a line, two points on the line,** the slope and a point, or the slope and y intercept.	0	2	The NxG WV objective addresses both linear and exponential functions.
M.1HS.LER.17 Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function. *(Limit to comparisons between exponential and linear models.)*			0	The NxG WV objective stresses comparisons between function families.
M.1HS.LER.18 Interpret the parameters in a linear or exponential function in terms of a context.			0	The NxG WV objective stresses the interpretation of parameters.
M.1HS.RWE.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.			0	The NxG WV objective stresses need for a justification of the solution method and each step in the method.

M.1HS.RWE.2 Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.	**M.O.A1.2.2** create and **solve multi-step linear equations,** absolute value equations, **and linear inequalities in one variable,** (with and without technology); apply skills toward solving practical problems such as distance, mixtures or motion and judge the reasonableness of solutions.	0	2	The NxG WV objective focuses on linear equations and inequalities.
	M.O.A1.2.3 evaluate data provided, given a real-world situation, select an appropriate **literal equation and solve for a needed variable.**	0	2	The NxG WV objective focuses on literal equations.
M.1HS.RWE.3 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.	**M.O.A1.2.9** create and **solve systems of linear equations** graphically and numerically **using the elimination method** and the substitution method, given a real-world situation.	0	1	The NxG WV objective emphasizes student understanding of the reasonableness of the solution method.
M.1HS.RWE.4 Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.	**M.O.A1.2.9** create and solve systems of linear equations graphically and numerically using the elimination method and the substitution method, given a real-world situation.	0	3	There is a strong alignment.
M.1HS.DST.1 Represent data with plots on the real number line (dot plots, **histograms, and box plots).**	**M.O.A1.2.19** gather data to **create histograms, box plots,** scatter plots and normal distribution curves and use them to draw and support conclusions about the data.	0	1	The NxG WV objective stresses representing data graphically.
M.1HS.DST.2 Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.			0	The NxG WV CSO stresses comparing data sets.
M.1HS.DST.3 Interpret differences in shape, center, and spread in the context of the	**M.O.A1.2.19** gather data to create histograms, box plots, scatter plots and normal distribution curves and	0	1	The NxG WV objective is specific about the type of data analysis that is necessary.

data sets, accounting for possible effects of extreme data points (outliers).	**use them to draw and support conclusions about the data.**			
M.1HS.DST.4 Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.			0	The NxG WV objective stresses the use of two-way frequency tables.
M.1HS.DST.5 \Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. *a.* **Fit a function to the data; use functions fitted to data to solve problems in the context of the data.** *Use given functions or choose a function suggested by the context. Emphasize linear and exponential models.* b. Informally assess the fit of a function by plotting and analyzing residuals. *(Focus should be on situations for which linear models are appropriate.)* c. c. Fit a linear function for scatter plots that suggest a linear association.	**M.O.A1.2.5 analyze a given set of data and prove the existence of a pattern** numerically, algebraically and **graphically, write equations from the patterns and make inferences and predictions based on observing the pattern.**	0	1	The NxG WV objective specifies representing data on a scatter plot.
M.1HS.DST.5 Represent data on two quantitative variables on a scatter plot, **and describe how the variables are related.** *a.* **Fit a function to the data; use functions**	**M.O.A1.2.17 perform a linear regression (with and without technology),** • **compare and evaluate methods of fitting lines to data.**	0	1	The NxG WV objective also stresses analyzing residuals.

fitted to data to solve problems in the context of the data. *Use given functions or choose a function suggested by the context. Emphasize linear and exponential models.* b. Informally assess the fit of a function by plotting and analyzing residuals. *(Focus should be on situations for which linear models are appropriate.)* **c. c. Fit a linear function for scatter plots that suggest a linear association.**	• **identify the equation for the line of regression,** • examine the correlation coefficient to determine how well the line fits the data • **use the equation to predict specific values of a variable.**			
M.1HS.DST.6 Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data. (*Build on students' work with linear relationships in eighth grade and introduce the correlation coefficient. The focus here is on the computation and interpretation of the correlation coefficient as a measure of how well the data fit the relationship.)*	**M.O.A1.2.5 analyze a given set of data and prove the existence of a pattern numerically, algebraically and graphically, write equations from the patterns** and make inferences and predictions based on observing the pattern.	0	2	The NxG WV objective interprets the linear model in the context of the problem and introduces the correlation coefficient.
M.1HS.DST.6 Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data. (*Build on students' work with linear relationships in eighth grade and introduce the correlation coefficient. The focus here is on the computation and interpretation of the correlation coefficient as a measure of how well the data fit*	**M.O.A1.2.17** perform a linear regression (with and without technology), • compare and evaluate methods of fitting lines to data. • identify the equation for the line of regression, • examine the correlation coefficient to determine how well the line fits the data	0	3	There is a strong alignment.

the relationship.)	• use the equation to predict specific values of a variable.			
M.1HS.DST.7 Compute (using technology) and interpret the correlation coefficient of a linear fit.	**M.O.A1.2.1** perform a linear regression (with and without technology), • compare and evaluate methods of fitting lines to data. • identify the equation for the line of regression, • examine the correlation coefficient to determine how well the line fits the data • use the equation to predict specific values of a variable.	0	3	There is a strong alignment.
M.1HS.DST.8 Distinguish between correlation and causation. (*The important distinction between a statistical relationship and a cause-and-effect relationship arises here.)*			0	The NxG WV objective stresses correlation and causation.
M.1HS.CPC.1 Know **precise definitions** of angle, circle, perpendicular line, parallel line, and line segment, based on the **undefined notions** of point, line, distance along a line, and distance around a circular arc.	**M.O.G.3.1** represent geometric figures, such as points, lines, planes, segments, rays, and angles pictorially with proper identification and **distinguish between undefined and defined terms.**	-1	1	The NxG WV objective clearly identifies required vocabulary.
M.1HS.CPC.2 Represent **transformations in the plane** using, e.g., transparencies and geometry software; **describe transformations as functions that take points in the plane as inputs and give other points as outputs.** Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch).	**M.O.7.3.3 apply rotations, reflections, translations to plane figures and determine the coordinates of its transformation** and compare and contrast the new figure with the original.	2	2	The NxG WV objective stresses comparing transformations that preserve distance and angle to those that do not.
	M.O.G.3.19 create and apply concepts using transformational geometry and laws of symmetry, of a • **reflection,**	-1	3	The NxG WV objective stresses transformations in the coordinate plane.

	• **translation,** • **rotation,** • **glide reflection,** • **dilation of a figure, and develop logical arguments for congruency and similarity.**			
M.1HS.CPC.3 Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.	**M.O.G.3.19 create and apply concepts using transformational geometry and laws of symmetry, of a** • **reflection,** • translation, • **rotation,** • glide reflection, • dilation of a figure, and develop logical arguments for congruency and similarity.	-1	1	The NxG WV objective addresses specific quadrilaterals and regular polygons.
M.1HS.CPC.4 Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, **parallel lines**, and line segments.	**M.O.G.3.6 compare and contrast the relationships between angles formed by two lines cut by a transversal when lines are parallel and when they are not parallel, and use the results to develop concepts that will justify parallelism.**	-1	1	The NxG WV objective goes beyond using parallel lines to define transformations.
	M.O.G.3.19create and apply concepts using transformational geometry and laws of symmetry, of a • **reflection,** • **translation,** • **rotation,** • glide reflection, • dilation of a figure, and develop logical arguments for congruency and similarity.	-1	1	The NxG WV objective stresses developing definitions of transformations in terms of geometric figures.
M.1HS.CPC.5 Given a geometric figure and a rotation, reflection, or translation, draw the	**M.O.G.3.19** create and **apply concepts using transformational geometry and laws of symmetry, of**	-1	1	The NxG WV objective stresses specifying a sequence of transformations.

transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.	**a** • **reflection,** • **translation,** • **rotation,** • **glide reflection,** • dilation of a figure, **and develop logical arguments for congruency and similarity.**			
M.1HS.CPC.6 Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; **given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent.**	**M.O.G.3.19** create and **apply concepts using transformational geometry and laws of symmetry,** of a • reflection, • translation, • rotation, • glide reflection, • dilation of a figure, **and develop logical arguments for congruency and similarity.**	-1	1	The NxG WV objective uses rigid motion transformations to develop congruency.
M.1HS.CPC.7 Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent.	**M.O.G.3.7 make conjectures and justify congruence relationships with an emphasis on triangles** and employ these relationships to solve problems.	-1	1	The NxG WV objectives emphasize rigid motion transformations.
	M.O.G.3.19 create and **apply concepts using transformational geometry and laws of symmetry,** of a • reflection, • translation, • rotation, • glide reflection, • dilation of a figure**, and develop logical arguments for congruency** and similarity.	-1	1	The NxG WV objective stresses triangle congruency.
M.1HS.CPC.8 Explain how the	**M.O.G.3.7 make conjectures and**	-1	1	The NxG WV objectives emphasize rigid

criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions.	**justify congruence relationships with an emphasis on triangles** and employ these relationships to solve problems.			motion transformations.
	M.O.G.3.19 create and **apply concepts using transformational geometry** and laws of symmetry, of a • reflection, • translation, • rotation, • glide reflection, • dilation **of a figure, and develop logical arguments for congruency** and similarity.	-1	1	The NxG WV objective stresses triangle congruency.
M.1HS.CPC.9 Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). *Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment;* *and constructing a line parallel to a given line through a point not on the line.*	**M.O.7.3.1 identify and construct** • **angle-pairs adjacent, complementary, supplementary, vertical** • **congruent segments and angles** • **perpendicular bisectors of segments** • **angle-bisectors.**	2	2	The NxG WV objective requires students to construct a line parallel to a given line.
M.1HS.CPC.10 Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.			0	The NxG WV objective stresses specific constructions.
M.1HS.CAG.1 Use coordinates to prove simple geometric theorems algebraically. *For example, prove or disprove that a figure defined by four given points in the coordinate plane is a*	**M.O.G.3.17 apply concepts of analytical geometry such as formulas for distance, slope, and midpoint and apply these to finding dimensions of polygons on the coordinate plane.**	-1	2	The NxG WV objective requires students use coordinates to prove geometric theorems.

rectangle; prove or disprove that the point (1, √3) lies on the circle centered at the origin and containing the point (0, 2).				
M.1HS.CAG.2 Prove the slope criteria for parallel and perpendicular lines; **use them to solve geometric problems (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point).**(*Relate work on parallel lines to work on M.1HSRWE.3 involving systems of equations having no solution or infinitely many solutions.)*	**M.O.A2.2.1 determine equations of lines including parallel, perpendicular, vertical and horizontal lines, and compare and contrast the properties of these equations.**	-2	2	The NxG WV objective stresses proof.
M.1HS.CAG.3 Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.*(*Provides practice with the distance formula and its connection with the Pythagorean theorem.)*	**M.O.G.3.17** apply concepts of analytical geometry such as formulas for distance, slope, and midpoint and apply these to finding dimensions of polygons on the coordinate plane.	-1	3	There is a strong alignment.

High School Mathematics—Math 2

How to Read the Crosswalk Document

The West Virginia Crosswalk document is designed to help readers easily understand the similarities and differences between the 21st Century Content Standards and Objectives for English Language Arts and Mathematics in WV Schools and the Next Generation WV Content Standards and Objectives for English Language Arts and Mathematics that have been aligned with the *Common Core State Standards for English Language Arts and Literacy in History/Social Studies, Science and Technical Subjects* and the *Common Core State Standards for Mathematics.*

NxG WV State Objective Aligned to CCSS	WV 21st Century Objective	Grade △	Alignment	Comment
M.2HS.ENS.1 Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for **radicals in terms of rational exponents**. *For example, we define 51/3 to be the cube root of 5 because we want (51/3)3 = 5(1/3)3 to hold, so (51/3)3 must equal 5.*	**M.O.A2.2.4** simplify expressions involving **radicals and fractional exponents**, convert between the two forms, and solve equations containing radicals and exponents.	-1	1	The NxG WV objective requires an explanation of the meaning of rational exponents.
M.2HS.ENS.2 Rewrite **expressions involving radicals and rational exponents** using the	**M.O.A2.2.4** simplify **expressions involving radicals and fractional exponents**, convert between the two	-1	2	The NxG WV objective focuses on using the properties of exponents to rewrite expressions.

properties of exponents.	forms, and solve equations containing radicals and exponents.			
	M.O.A1.2.13 simplify radical expressions through adding, subtracting, multiplying and dividing exact and approximate forms	+1	2	In addition to rewriting expressions involving radicals, the NxG WV objective includes rewriting expressions involving rational exponents.
M.2HS.ENS.3 Explain why sums and products of rational numbers are rational, that the sum of a rational number and an irrational number is irrational, and that the product of a nonzero rational number and an irrational number is irrational. *Connect to physical situations, e.g., finding the perimeter of a square of area 2.*			0	
M.2HS.ENS.4 Know there is a complex number *i* such that *i2* = −1, and every complex number has the form *a* + *bi* with *a* and *b* real.	**M.O.A2.2.3** define complex numbers, simplify powers of 'i', perform basic operations with complex numbers, and give answers as complex numbers in simplest form.	-1	3	There is a strong alignment.
M.2HS.ENS.5 Use the relation *i2* = –1 and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers. *Limit to multiplications that involve i^2 as the highest power of.*	**M.O.A2.2.3** define complex numbers, simplify powers of 'i', perform basic operations with complex numbers, and give answers as complex numbers in simplest form.	-1	3	The NxG WV objective includes using the commutative, associative, and distributive properties.
M.2HS.ENS.6 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**. *Focus on polynomial expressions that simplify to forms that are linear or quadratic in a positive integer power of x.*	**M.O.8.2.3 Add and subtract polynomials** limited to two variables and positive exponents	+2	1	The NxG WV objective includes recognizing and understanding the analogous relationship between polynomials and integers. In addition, the objective also includes multiplying polynomials and does not put limits on the types of polynomials under consideration.
	M.O.A1.2.10 simplify and evaluate algebraic expressions • **add and subtract polynomials**	+1	1	The NxG WV objective includes recognizing and understanding the analogous relationship between polynomials and integers.

	multiply and divide **binomials by binomials or monomials.**			
M.2HS.QFM.1 For a function that models a **relationship between two quantities**, **interpret key features of graphs** and tables in terms of the quantities, and **sketch graphs showing key features** given a verbal description of the relationship. ***Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.***	**M.O.A1.2.7** analyze situations and solve problems by **determining the equation of a line given a graph of a line, two points on the line, the slope and a point, or the slope and y intercept**.	+1	1	The NxG WV objective includes modeling with tables and sketching graphs, as well as additional features of functions.
	M.O.PC.2.1 investigate and **sketch the graphs of polynomials and rational functions by analyzing and using the characteristics of zeros, upper and lower bounds, y-intercepts, symmetry, asymptotes and end behavior, maximum and minimum points, and domain and range**	-2	2	The NxG WV objective includes key features of tables.
	M.O.A1.2.15 describe real life situations involving exponential growth and decay equations including $y=2^x$ and $y= (½)^x$; **compare the equation with attributes of an associated table and graph** to demonstrate an understanding of their interrelationship.	+1	1	The NxG WV objective focuses on modeling relationships between two quantities and key features of graphs and tables.
M.2HS.QFM.2 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.*			0	
M.2HS.QFM.3 Calculate and	**M.O.A1.2.6 determine the slope of a**	+1	1	The NxG WV objective includes

interpret **the average rate of change of a function (presented symbolically or as a table)** over a specified interval. Estimate the rate of change from a graph. *Focus on quadratic functions; compare with linear and exponential functions studied in Mathematics I.*	**line through a variety of strategies** (e.g. given an equation or graph).			interpreting the rate of change over a specified interval as well as estimating the rate of change.
M.2HS.QFM.4 Graph **functions expressed symbolically** and show key features of the graph, **by hand in simple cases and using technology for more complicated cases.** **a. Graph linear and quadratic functions** and show intercepts, maxima, and minima. **a. b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.** *Compare and contrast absolute value, step and piecewise defined functions with linear, quadratic, and exponential functions. Highlight issues of domain, range and usefulness when examining piecewise-defined functions.*	**M.O.A2.2.8** analyze families of functions and their transformations; **recognize linear, quadratic, radical, absolute value, step, piece-wise, and exponential functions**; analyze connections among words, graphs, tables and equations when solving practical problems **with and without technology.**	-1	3	There is a strong alignment.
	M.O.A1.2.14 choose the most efficient method to solve quadratic equations by • **graphing (with and without technology),** • factoring • quadratic formula and draw reasonable conclusions about a situation being modeled	+1	1	The NxG WV objective includes a variety of functions.
	M.O.PC.2.1 investigate and **sketch the graphs of** polynomials and rational **functions by analyzing and using the characteristics of zeros, upper and lower bounds, y-intercepts, symmetry, asymptotes and end behavior, maximum and minimum points, and domain and range.**	-2	1	The NxG WV objective includes a variety of functions.
M.2HS.QFM.5 Write a function defined by an expression in	**M.O.PC.2.1 investigate and sketch the graphs** of polynomials and	-2	1	The NxG WV objective stresses contextual connections to key features of the graphs.

different but equivalent forms to reveal and explain different properties of the function. **a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.** **b. b. Use the properties of exponents to interpret expressions for exponential functions**. *For example, identify percent rate of change in functions such as y = (1.02) t, y = (0.97) t, y = (1.01)12t, y = (1.2) t/10, and classify them as representing exponential growth or decay. M.2HS.QFM.5b extends the work begun in Mathematics I on exponential functions with integer exponent.*	rational functions by analyzing and **using the characteristics of zeros, upper and lower bounds, y-intercepts, symmetry, asymptotes and end behavior, maximum and minimum points, and domain and range.**			
	M.O.A2.2.5 solve quadratic equations over the set of complex numbers: apply the **techniques of factoring, completing the square**, and the quadratic formula; use the discriminate to determine the number and nature of the roots; identify the maxima and minima; use words, graphs, tables, and equations to generate and **analyze solutions to practical problems**.	-1	1	The NxG WV objective focuses on writing functions to reveal and explain properties.
	M.O.PC.2.5 compare laws of exponents to properties of logarithms; **solve equations and practical problems involving exponential and** logarithmic **expressions**, including natural and common logarithms; confirm solutions graphically and numerically.	-2	1	NxG WV objective requires the use of properties of exponents to interpret expressions for exponential functions.
M.2HS.QFM.6 Compare **properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).** *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger*	**M.O.PC.2.11** use **multiple representations, such as words, graphs, tables, and equations**, to solve practical problems involving **logarithmic, exponential**, polynomial, rational, and radical functions; **explain how the representations are related to each other, as well as to the problem.**	-2	2	The NxG WV objective compares properties of functions represented in different formats.

maximum. ***Focus on expanding the types of functions considered to include, linear, exponential, and quadratic.*** *Extend work with quadratics to include the relationship between coefficients and roots, and that once roots are known, a quadratic equation can be factored.*				
M.2HS.QFM.7 Write a function that describes a relationship between two quantities. **a.** Determine an explicit expression, a recursive process, or steps for calculation from a context. **b.** b. Combine **standard function types using arithmetic operations**. F*or example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model. Focus on situations that exhibit a quadratic or exponential relationship.*	**M.O.A2.2.7** define a function and find its zeros; express the domain and range using interval notation; find the inverse of a function; find the value of a function for a given element in its domain; and **perform basic operations on functions** including composition of functions.	-1	1	The NxG WV objective includes writing functions that describes relationship between two quantities using both recursive and explicit forms.
M.2HS.QFM.8 Identify the effect on the graph of replacing *f(x)* by *f(x) + k, k f(x), f(kx),* and *f(x + k)* for specific values of *k* (both positive and negative); find the value of *k* given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. *Include recognizing*	**M.O.PC.3.1 graph** functions and conic sections using transformations.	-2	1	The NxG WV objective provides specifics regarding the process required to arrive at the product.
	M.O.A2.2.8 analyze families of functions and their transformations; recognize linear, quadratic, radical, absolute value, step, piece-wise, and exponential functions; analyze connections among	-1	2	The NxG WV objective focuses on function families and their transformations.

even and odd functions from their graphs and algebraic expressions for them. Focus on quadratic functions and consider including absolute value functions.	words, graphs, tables and equations when solving practical problems with and without technology.			
M.2HS.QFM.9 Find inverse function a. Solve an equation of the form f(x) = c for a simple function f that has an inverse and write an expression for the inverse. For example, $f(x)= 2 x^3$ or f(x) = (x+1)/(x-1) for $x \neq 1$. *Focus on linear functions but consider simple situations where the domain of the function must be restricted in order for the inverse to exist, such as* $f(x) = x^2, x>0$	**M.O.A2.2.7** define a function and find its zeros; express the domain and range using interval notation; **find the inverse of a function**; find the value of a function for a given element in its domain; and perform basic operations on functions including composition of functions.	-1	1	The NxG WV objective focuses on inverse functions including simple cases where it is necessary to restrict the function domain in order for its inverse function to exist.
M.2HS.QFM.10 Using graphs and tables, observe that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.			0	
M.2HS.EE.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			0	

depending on P. *Focus on quadratic and exponential expressions. Exponents are extended from the integer exponents found in Mathematics I to rational exponents focusing on those that represent square or cube roots*				
M.2HS.EE.2 Use the structure of an expression to identify ways to rewrite it. For example, see $x^4 - y^4$ as $(x^2)^2 - (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 - y^2)(x^2 + y^2)$.	**M.O.A2.2.2** factor higher order polynomials by applying various methods including factoring by grouping and the sum and difference of two cubes; analyze and describe the relationship between the factored form and the graphical representation.	-1	3	The NxG WV objective requires analyzing the structure of an expression before rewriting it.
M.2HS.EE.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%.***	**M.O.A1.2.14** choose the most efficient method to **solve quadratic equations by** • graphing (with and without technology), • **factoring** • quadratic formula and draw reasonable conclusions about a situation being modeled.	+1	1	The NxG WV objective stresses information that can be revealed by different forms of quadratic equations.
	M.O.A2.2.2 factor higher order polynomials by applying various methods including factoring by grouping and the sum and difference of two cubes**; analyze and describe the relationship between the factored form and the graphical representation.**	-1	2	The NxG WV objective emphasizes the importance of procedural fluency in developing conceptual understanding of key features of functions.
	M.O.A2.2.15 identify a real life situation that exhibits characteristics of change that can be modeled by a quadratic equations; pose a questions; make a hypothesis as to the answer; develop, justify, and implement a method to	-1	1	The NxG WV objective focuses on expressions includes factoring, completing the square, and using properties of exponents.

It is important to balance conceptual understanding and procedural fluency in work with equivalent expressions. For example, development of skill in factoring and completing the square goes hand-in-hand with understanding what different forms of a quadratic expression reveal.	collect, organize and analyze related data; extend the nature of collected, discrete data to that of a continuous function that describes the known data set; generalize the results to make a conclusion; compare the hypothesis and the conclusion; present the project numerically, analytically, graphically and verbally using the predictive and analytic tools of algebra (with and without technology).			
M.2HS.EE.4 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. Extend work on linear and exponential equations in Mathematics I to quadratic equations.*	**M.O.A1.2.2** create and solve multi-step linear equations, absolute value equations, and linear inequalities in one variable, (with and without technology); apply skills toward solving practical problems such as distance, mixtures or motion and judge the reasonableness of solutions.	+1	3	The NxG WV objective applies to linear, quadratic, rational, and exponential functions.
M.2HS.EE.5 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.			0	
M.2HS.EE.6 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. Extend to formulas involving squared variables.*	**M.O.A1.2.3** evaluate data provided, given a real-world situation, select an appropriate literal equation and solve for a needed variable	+1	3	There is a strong alignment.
M.2HS.EE.7 Solve quadratic equations in one variable. a. Use the method of completing the square to transform any quadratic	**M.O.A1.2.14 choose the most efficient method to solve quadratic equations** by • graphing (with and without technology),	+1	1	The NxG WV objective focuses on solving equations that include complex solutions, deriving the quadratic formula, and recognizing when a solution will be complex.

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* ± *bi* for real numbers *a* and *b***. *Extend to solving any quadratic equation with real coefficients, including those with complex solutions.*	• **factoring** • **quadratic formula** and draw reasonable conclusions about a situation being modeled.			
	M.O.A2.2.5 solve quadratic equations over the set of complex numbers: apply the techniques of factoring, completing the square, and **the quadratic formula**; use the discriminate to determine the number and nature of the roots; identify the maxima and minima; use words, graphs, tables, and equations to generate and analyze solutions to practical problems.	-1	3	There is a strong alignment.
M.2HS.EE.8 Solve quadratic equations with real coefficients that have complex solutions.	**M.O.A2.2.5** solve quadratic equations over the set of complex numbers: apply the techniques of factoring, completing the square, and the quadratic formula; use the discriminate to determine the number and nature of the roots; identify the maxima and minima; use words, graphs, tables, and equations to generate and analyze solutions to practical problems.	-1	3	There is a strong alignment.
M.2HS.EE.9 (+) Extend polynomial identities to the complex numbers. *For example, rewrite $x^2 + 4$ as $(x + 2i)(x – 2i)$.*			0	
M.2HS.EE.10 (+) Know the Fundamental Theorem of Algebra; show that it is true for quadratic			0	

polynomials.				
M.2HS.EE.11 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 $x^2 + y^2 = 3$. Include systems that lead to work with fractions. For example, finding the intersections between x^2 and $y^2 = 1$ and y = (x+1)/2 leads to the point (3/5, 4/5) on the unit circle, corresponding to the Pythagorean triple $3^2 + 4^2 = 5^2$.*			0	
M.2HS.AOP.1 Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events ("or," "and," "not").			0	
M.2HS.AOP.2 Understand that two events *A* and *B* are independent if the probability of *A* and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent.	**M.O.8.5.2** compare the experimental and theoretical probability of a given situation (including compound probability of a dependent and independent event).	+2	3	There is a strong alignment.
M.2HS.AOP.3 Understand the conditional probability of *A* given *B* as *P(A* and *B)/P(B)*, and **interpret independence of *A* and *B*** as saying that the conditional probability of *A* given *B* is the same as the probability of *A*, and the conditional probability of *B* given *A* is the same as the probability of *B*.	**M.O.8.5.2** compare the experimental and theoretical probability of a given situation (**including compound probability of a dependent and independent event**).	+2	3	There is a strong alignment.
M.2HS.AOP.4 Construct and			0	

interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. *For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results. Build on work with two-way tables from Mathematics I to develop understanding of conditional probability and independence.*				
M.2HS.AOP.5 Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. *For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.*			0	
M.2HS.AOP.6 Find the conditional probability of *A* given *B* as the fraction of *B*'s outcomes that also belong to *A*, and interpret the answer in terms of the model.			0	
M.2HS.AOP.7 Apply the Addition Rule, *P (A or B) = P (A) + P (B) – P (A* and *B)*, and interpret the answer in terms of the model.		+1	0	

M.2HS.AOP.8 (+) Apply the general Multiplication Rule in a uniform probability model, *P (A* and *B) = P (A) P (B|A) = P (B) P (A|B)*, and interpret the answer in terms of the model.		+1	0	
M.2HS.AOP.9 (+) Use permutations and combinations to compute probabilities of compound events and solve problems.	**M.O.8.5.1** determine and explain whether a real-world situation involves permutations or combinations, then use appropriate technology to solve the problem	+2	3	There is a strong alignment.
M.2HS.AOP.10 (+) Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator).			0	
M.2HS.AOP.11 (+) Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game). *This unit sets the stage for work in Mathematics III, where the ideas of statistical inference are introduced. Evaluating the risks associated with conclusions drawn from sample data (i.e. incomplete information) requires an understanding of probability concepts.*			0	
M.2HS.STP.1 Verify experimentally the properties of dilations given by a center and a scale factor. a. A dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged. b. The dilation of a line	**M.O.G.3.19** create and **apply concepts** using transformational geometry and laws of symmetry, of a • reflection, • translation, • rotation, • glide reflection, • **dilation of a figure, and develop logical arguments for** congruency and **similarity.**	0	1	The NxG WV objective requires a depth of knowledge focused on dilations.

segment is longer or shorter in the ratio given by the scale factor.				
M.2HS.STP.2 Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.	**M.O.G.3.19** create and apply concepts using transformational geometry and laws of symmetry, of a • reflection, • translation, • rotation, • glide reflection, • dilation of a figure, and develop logical arguments for congruency and similarity.	0	3	There is a strong correlation.
M.2HS.STP.3 Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.	**M.O.G.3.19** create and **apply concepts using transformational geometry and laws of symmetry**, of a • reflection, • translation, • rotation, • glide reflection, • **dilation of a figure, and** • **develop logical arguments fo**r congruency and **similarity.**	0	3	There is a strong alignment.
M.2HS.STP.4 Prove theorems about lines and angles. *Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints. Implementation may be extended to include concurrence of perpendicular bisectors and angle bisectors as*	**M.O.G.3.4** validate conclusions by constructing logical arguments using both formal and informal methods with direct and indirect reasoning	0	3	There is a strong alignment.
	M.O.G.3.5 construct formal and informal proofs by applying definitions, theorems, and postulates related to such topics as • complementary, • supplementary, • vertical angles, • angles formed by perpendicular lines, and	0	3	There is a strong alignment.

preparation for M.2HS.C.3.	justify the steps			
	M.O.G.3.6 compare and contrast the relationships between angles formed by two lines cut by a transversal when lines are parallel and when they are not parallel, and use the results to develop concepts that will justify parallelism.	0	3	There is a strong alignment.
M.2HS.STP.5 Prove theorems about triangles. *Theorems include: measures of interior angles of a triangle sum to 180°; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point. Encourage multiple ways of writing proofs, such as in narrative paragraphs, using flow diagrams, in two-column format, and using diagrams without words. Students should be encouraged to focus on the validity of the underlying reasoning while exploring a variety of formats for expressing that reasoning*	**M.O.G.3.4** validate conclusions by constructing logical arguments using both formal and informal methods with direct and indirect reasoning.	0	3	There is a strong alignment.
M.2HS.STP.6 Prove **theorems about parallelograms.** *Theorems include: opposite sides are congruent, opposite angles are congruent, the diagonals of a parallelogram bisect each other, and conversely, rectangles are parallelograms with congruent diagonals. Encourage multiple ways of writing proofs, such as in narrative paragraphs, using flow*	**M.O.G.3.2 differentiate and apply inductive and deductive reasoning, justify conclusions** in real-world settings.	0	2	The NxG WV objective focuses on proving theorems about parallelograms.
	M.O.G.3.4 validate conclusions by constructing logical arguments using both formal and informal methods with direct and indirect reasoning.	0	3	There is a strong alignment.

diagrams, in two-column format, and using diagrams without words. Students should be encouraged to focus on the validity of the underlying reasoning while exploring a variety of formats for expressing that reasoning.				
M.2HS.STP.7 Prove **theorems about triangles**. *Theorems include: a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved using triangle similarity.*	**M.O.G.3.2 differentiate and apply inductive and deductive reasoning, justify conclusions** in real-world settings.	0	2	The NxG WV objective focuses on proving theorems about triangles.
	M.O.G.3.4 validate conclusions by constructing logical arguments using both formal and informal methods with direct and indirect reasoning	0	3	There is a strong alignment.
M.2HS.STP.8 Use **congruence and similarity criteria for triangles** to solve problems and **to prove relationships in geometric figures.**	**M.O.G.3.2 differentiate and apply inductive and deductive reasoning**, **justify conclusions** in real-world settings.	0	3	There is a strong alignment with specific focus on congruence and similarity.
	M.O.G.3.4 validate conclusions by constructing logical arguments using both formal and informal methods with direct and indirect reasoning	0	3	There is a strong alignment with specific focus on congruence and similarity.
	M.O.G.3.7 make conjectures and justify congruence relationships **with an emphasis on triangles and employ these relationships to solve problems**	0	3	There is a strong alignment with specific focus on congruence and similarity.
M.2HS.STP.9 Find the point on a directed line segment between two given points that partitions the segment in a given ratio.			0	
M.2HS.SPT.10 Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to	**M.O.G.3.11 verify** and justify **the basis for the trigonometric ratios by applying properties of similar**	0	2	The NxG WV objective emphasizes the importance of similarity in establishing definitions of trigonometric ratios for acute angles.

definitions of trigonometric ratios for acute angles.	**triangles** and use the results to find inaccessible heights and distances. Using the ratios of similar triangles to find unknown side lengths and angle measures, construct a physical model that illustrates the use of a scale drawing in a real-world situation.			
M.2HS.SPT.11 Explain and use the relationship between the sine and cosine of complementary angles.			0	
M.2HS.SPT.12 Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.	**M.O.G.3.12** apply the Pythagorean Theorem and its converse to solve real-world problems and derive the special right triangle relationships (i.e. 30-60-90, 45-45-90).	0	3	There is a strong correlation.
	M.O.T.3.1 apply the right triangle definition of the six trigonometric functions of an angle to determine the values of the function values of an angle in standard position given a point on the terminal side of the angle. • determine the value of the other trigonometric functions given the value of one of the trigonometric functions and verify these values with technology. • **using geometric principles and the Pythagorean Theorem, determine the six function values for the special angles and the quadrantal angles and use them in real-world problems.** • compare circular functions	-2	3	There is a strong alignment.

	and the trigonometric function values to draw inferences about coterminal angles and co-functions.			
M.2HS.SPT.13 Prove the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$ and use it to find sin (θ), cos (θ), or tan (θ), given sin (θ), cos (θ), or tan (θ), and the quadrant of the angle. *In this course, limit θ to angles between 0 and 90 degrees. Connect with the Pythagorean theorem and the distance formula. Extension of trigonometric functions to other angles through the unit circle is included in Mathematics III.*			0	
M.2HS.C.1 Prove **that all circles are similar**.	**M.O.G.3.2 differentiate and apply inductive and deductive reasoning, justify conclusions** in real-world settings.	0	2	The emphasis in the NxG WV objective is on proving similarities of circles.
	M.O.G.3.4 validate conclusions by constructing logical arguments using both formal and informal methods with direct and indirect reasoning.	0	3	There is a strong correlation.
M.2HS.C.2 Identify **and describe relationships among inscribed angles**, radii, and **chords**. *Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle.*	**M.O.G.3.13 investigate measures of angles formed by chords**, tangents, and secants of a circle **and draw conclusions for the relationship to its arcs**.	0	1	The NxG WV objective emphasizes relationships within a circle.
M.2HS.C.3 Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed			0	

in a circle.				
M.2HS.C.4 (+) Construct a tangent line from a point outside a given circle to the circle.			0	
M.2HS.C.5 Derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius, and define the radian measure of the angle as the constant of proportionality; derive the formula for the area of a sector. *Emphasize the similarity of all circles. Note that by similarity of sectors with the same central angle, arc lengths are proportional to the radius.* ***Use this as a basis for introducing radian as a unit of measure.*** *It is not intended that it be applied to the development of circular trigonometry in this course.*	**M.O.T.3.2 convert angle measures from degrees to radians (and vice versa)** and apply this concept to • create a data set, analyze, and formulate a hypotheses to test and develop formulas for the arc length, area of a sector, and angular velocity and use the formula for application in the real-world. • compare and contrast the concepts of angular velocity and linear velocity and demonstrate by graphical or algebraic means relationship between them and apply to real-world problems.	-2	1	NxG WV objective establishes the importance of similarity of sectors with the same central angle as a conceptual basis for development of radian measure.
M.2HS.C.6 Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation.	**M.O.G.3.2** differentiate and **apply inductive and deductive reasoning,** justify conclusions in real-world settings.	0	1	The emphasis in the NxG WV objective is on deriving the equation of a given circle.
M.2HS.C.7 Derive the equation of a parabola given a focus and directrix. *Connect the equations of circles and parabolas to prior work with quadratic equations. The directrix should be parallel to a coordinate axis.*	**M.O.G.3.2** differentiate and **apply inductive and deductive reasoning,** justify conclusions in real-world settings.	0	1	The emphasis in the NxG WV objective is on deriving the equation of parabola given the focus and directrix.
M.2HS.C.8 Use coordinates to prove simple geometric theorems algebraically. *For example, prove or disprove that a figure defined by four given points in the coordinate*	**M.O.G.3.17** apply concepts of analytical geometry such as formulas for distance, slope, and midpoint and apply these to finding dimensions of polygons on the coordinate plane.	0	3	There is a strong alignment.

plane is a rectangle; prove or disprove that the point (1, √3) lies on the circle centered at the origin and containing the point (0, 2). Include simple proofs involving circles.				
M.2HS.C.9 Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. *Use dissection arguments, Cavalieri's principle, and informal limit arguments. Informal arguments for area and volume formulas can make use of the way in which area and volume scale under similarity transformations: when one figure in the plane results from another by applying a similarity transformation with scale factor k, its area is k^2 times the area of the first.*			0	
M.2HS.C.10 Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems. *Volumes of solid figures scale by k^3 under a similarity transformation with scale factor k.*	**M.O.8.4.1** select and **apply an appropriate method to solve**; justify the method and the reasonableness of the solution of **problems involving volume of** • **prisms** • **cylinders** • **prisms** • **cones** • **spheres** in real life situations.	+2	3	There is a strong alignment.

High School Mathematics--Math 3

How to Read the Crosswalk Document

The West Virginia Crosswalk document is designed to help readers easily understand the similarities and differences between the 21st Century Content Standards and Objectives for English Language Arts and Mathematics in WV Schools and the Next Generation WV Content Standards and Objectives for English Language Arts and Mathematics that have been aligned with the *Common Core State Standards for English Language Arts and Literacy in History/Social Studies, Science and Technical Subjects* and the *Common Core State Standards for Mathematics.*

NxG WV State Objective Aligned to CCSS	WV 21st Century Objective	Grade △	Alignment	Comment
M.3HS.IC.1 Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve. *(While students may have heard of the normal distribution, it is unlikely that they will have prior experience*	**M.O.8.5.5** draw inferences, make conjectures and construct convincing arguments involving • different effects that changes in data values have on measures of central tendency • misuses of statistical or numeric information, based on data analysis of same and different sets of data.	+3	3	The NxG WV objective incorporates technology as a tool.
	M.O.A1.2.19 gather **data to create** histograms, box plots, scatter plots and **normal distribution curves and use them to draw and support conclusions about the**	+2	2	The NxG WV objective incorporates technology as a tool and emphasizes that there are data sets for which such a procedure is not appropriate.

using it to make specific estimates. Build on students' understanding of data distributions to help them see how the normal distribution uses area to make estimates of frequencies (which can be expressed as probabilities). Emphasize that only some data are well described by a normal distribution.)	**data**.			
M.3HS.IC.2 Understand that statistics allows inferences to be made about population parameters based on a random sample from that population.	**M.O.PC.5.1** identify a real life situation that exhibits characteristics of exponential or logistic growth or decay; pose a question; make a hypothesis as to the answer; develop, justify, and **implement a method to collect, organize, and analyze related data;** extend the nature of collected, discrete data to that of a continuous function that describes the known data set; generalize the results to make a conclusion; compare the hypothesis and the conclusion; present the project numerically, analytically, graphically and verbally using the predictive and analytic tools of pre-calculus (with and without technology).	-1	1	The NxG WV objective recognizes that a random sample is a legitimate representation of a larger population.
M.3HS.IC.3 Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. *For example, a model says a spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question*	**M.O.A1.2.20** design experiments to model and solve problems using the concepts of sample space and probability distribution.	+2	3	The NxG WV objective leaves the analysis process open-ended.
	M.O.PC.5.1 identify a real life situation that exhibits characteristics of exponential or logistic growth or decay; pose a question; make a hypothesis as to the answer;	-1	3	The NxG WV objective leaves the analysis process open-ended.

the model? (Include comparing theoretical and empirical results to evaluate the effectiveness of a treatment.)	develop, justify, and implement a method to collect, organize, and analyze related data; extend the nature of collected, discrete data to that of a continuous function that describes the known data set; generalize the results to make a conclusion; compare the hypothesis and the conclusion; present the project numerically, analytically, graphically and verbally using the predictive and analytic tools of pre-calculus (with and without technology).			
M.3HS.IC.4 Recognize the purposes of and differences among **sample surveys, experiments, and observational studies**; explain how randomization relates to each. (*Ways of collecting data and use graphical displays and summary statistics to make comparisons. These ideas are revisited with a focus on how the way in which data is collected determines the scope and nature of the conclusions that can be drawn from that data. The concept of statistical significance is developed informally through simulation as meaning a result that is unlikely to have occurred solely as a result of random selection in sampling or random assignment in an experiment.*	**M.O.PC.5.1** identify a real life situation that exhibits characteristics of exponential or logistic growth or decay; pose a question; make a hypothesis as to the answer; develop, justify, and **implement a method to collect, organize, and analyze related data**; extend the nature of collected, discrete data to that of a continuous function that describes the known data set; generalize the results to make a conclusion; compare the hypothesis and the conclusion; present the project numerically, analytically, graphically and verbally using the predictive and analytic tools of pre-calculus (with and without technology).	-1	1	The NxG WV objective recognizes that sample surveys, experiments, and observational studies may produce representations, but not necessarily exact models of populations.
M.3HS.IC.5 Use data from a	**M.O.A1.2.20** design experiments to	+2	1	The NxG WV objective recognizes that the

sample survey to estimate a population mean or proportion; develop a margin of error through the **use of simulation models for random sampling**.*(Focus on the variability of results from experiments—that is, focus on statistics as a way of dealing with, not eliminating, inherent randomness).*	model and solve problems using the **concepts of sample space and probability** distribution.			population estimated from a sample survey may not be valid.
	M.O.PC.5.1 identify a real life situation that exhibits characteristics of exponential or logistic growth or decay; pose a question; **make a hypothesis as to the answer; develop, justify, and implement a method to collect, organize, and analyze related data;** extend the nature of collected, discrete data to that of a continuous function that describes the known data set; generalize the results to make a conclusion; compare the hypothesis and the conclusion; present the project numerically, analytically, graphically and verbally using the predictive and analytic tools of pre-calculus (with and without technology).	-1	1	The NxG WV objective recognizes that the population estimated from a sample survey may not be valid.
M.3HS.IC.6 Use data from a randomized experiment to compare two treatments; **use simulations to decide if differences between parameters are significant**. *(Focus on the variability of results from experiments—that is, focus on statistics as a way of dealing with, not eliminating, inherent randomness).*	**M.O.PC.5.1** identify a real life situation that exhibits characteristics of exponential or logistic growth or decay; pose a question; **make a hypothesis as to the answer; develop, justify, and implement a method to collect, organize, and analyze related data;** extend the nature of collected, discrete data to that of a continuous function that describes the known data set; generalize the results to make a conclusion; compare the hypothesis and the conclusion; present the project numerically, analytically, graphically and verbally using the predictive and analytic tools of pre-calculus (with and without	-1	1	The NxG WV objective recognizes that the population estimated from a randomized experiment may not be valid.

	technology).			
M.3HS.IC.7 Evaluate reports based on data.	**M.O.PC.5.1** identify a real life situation that exhibits characteristics of exponential or logistic growth or decay; pose a question; make a hypothesis as to the answer; develop, justify, and implement a method to collect, organize, and analyze related data; extend the nature of collected, discrete data to that of a continuous function that describes the known data set; generalize the results to make a conclusion; compare the hypothesis and the conclusion; present the project numerically, analytically, graphically and verbally using the predictive and analytic tools of pre-calculus (with and without technology).	-1	3	The NxG WV objective leaves the analysis process open-ended.
M.3HS.IC.8 Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator).			0	
M.3HS.IC.9 (+) Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game). *(Extend to more complex probability models. Include situations such as those involving quality control or diagnostic tests that yields both false positive and false negative results.*	**M.O.A1.2.20** design experiments to model and solve problems using the concepts of sample space and probability distribution.	+2	3	The NxG WV objective emphasizes the importance of the analysis process.
M.3HS.PR.1 (+) Extend polynomial identities to the complex numbers. *For example, rewrite x2 + 4 as (x +*	**M.O.A2.2.5** solve quadratic equations over the set of complex numbers: apply the techniques of factoring, completing the square,	0	3	The NxG WV objective extends beyond quadratics.

2i) (x – 2i). (Build on work with quadratics equations in Mathematics II. Limit to polynomials with real coefficients.)	and the quadratic formula; use the discriminate to determine the number and nature of the roots; identify the maxima and minima; use words, graphs, tables, and equations to generate and analyze solutions to practical problems.			
M.3HS.PR.2 (+) **Know the Fundamental Theorem of Algebra**; show that it is true for quadratic polynomials.	**M.O.PC.2.2 solve higher order polynomial equations** utilizing techniques such as Descartes" Rule of Signs, upper and lower bounds, and the Rational Root Theorem.	-1	1	The NxG WV objective emphasizes the importance of using FTA in determining the number of factors in polynomial expressions.
M.3HS.PR.3 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.*			0	
M.3HS.PR.4 Use the structure of an expression to **identify ways to rewrite it**. For example, see $x^4 – y^4$ as $(x^2)^2 – (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 – y^2) (x^2 + y^2)$. *(Extend to polynomial and rational expressions.)*	**M.O.A2.2.5** solve quadratic equations over the set of complex numbers: **apply the techniques of factoring**, completing the square, and the quadratic formula; use the discriminate to determine the number and nature of the roots; identify the maxima and minima; use words, graphs, tables, and equations to generate and analyze	0	1	The NxG WV objective expands quadratics to high order polynomials.

	solutions to practical problems.			
M.3HS.PR.5 Derive the formula for the sum of a geometric series (when the common ratio is not 1), and use the formula to solve problems. *For example, calculate mortgage payments.* ★ *(Consider extending to infinite geometric series in curricular implementations of this course description.)*	**M.O.PC.2.6** solve problems involving the sum of finite and infinite sequences and series, including Sigma notation.	-1	3	The NxG WV objective emphasizes the derivation of the formula.
M.3HS.PR.6 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. *(Extend beyond the quadratic polynomials found in Mathematics II.)*	**M.O.8.2.3** add and subtract polynomials limited to two variables and positive exponents.	+3	3	The NxG WV objective emphasizes the comparisons of different fields in mathematics.
	M.O.A1.2.10 simplify and evaluate algebraic expressions • add and subtract polynomials • multiply and divide binomials by binomials or monomials.	+2	3	The NxG WV objective emphasizes the comparisons of different fields in mathematics.
M.3HS.PR.7 Know and apply the Remainder Theorem: For a 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 $p(x)$.			0	
M.3HS.PR.8 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**.	**M.O.PC.2.1** investigate and sketch the graphs of polynomials and rational functions by analyzing and **using the characteristics of zeros**, upper and lower bounds, y-intercepts, symmetry, asymptotes and end behavior, maximum and minimum points, and domain and range.	-1	2	The NxG WV objective stresses the importance of finding zeroes when graphing polynomial functions.
	M.O.PC.2.2 solve higher order polynomial equations utilizing	-1	1	The NxG WV objective stresses the importance of finding zeroes when graphing

	techniques such as Descartes" Rule of Signs, upper and lower bounds, and the Rational Root Theorem.			polynomial functions.
M.3HS.PR.9 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.(This cluster has many possibilities for optional enrichment, such as relating the example to the solution of the system* $u^2+v^2=1$, $v = t(u+1)$, *relating the Pascal triangle property of binomial coefficients to* $(x+y)^{n+1} = (x+y)(x+y)^n$, *deriving explicit formulas for the coefficients, or proving the binomial theorem by induction.)*			0	
M.3HS.PR.10 (+) 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.	**M.O.PC.2.3** relate Pascal's Triangle and the Binomial Theorem; use both to expand binomials with positive integral exponents.	-1	3	There is a strong correlation.
M.3HS.PR.11 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	**M.O.A1.2.16** simplify and evaluate rational expressions • add, subtract, multiply and divide • determine when an expression is undefined.	+2	3	The NxG WV objective compares polynomial long division to concepts from arithmetic long division.

the more complicated examples, a computer algebra system.*(The limitations on rational functions apply to the rational expressions.)*				
M.3HS.PR.12 (+) 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. *(Requires the general division algorithm for polynomials).*	**M.O.A1.2.16** simplify and evaluate rational expressions • add, subtract, multiply and divide • determine when an expression is undefined.	+2	3	The NxG WV objective compares rational expressions to properties of rational numbers.
M.3HS.PR.13 Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.*(Extend to simple rational and radical equations)*			0	
M.3HS.PR.14 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.★ *(Include combinations of*	**M.O.A1.2.9** create and **solve systems of linear equations graphically and numerically using** the elimination method and the **substitution method**, given a real-world situation.	+2	2	The NxG WV objective expands to higher order polynomial equations.

linear, polynomial, rational, radical, absolute value, and exponential functions.)				
M.3HS.PR.15 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.★ Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.*(Relate to the relationship between zeros of quadratic functions and their factored forms.)*	**M.O.PC.2.1** investigate and sketch the graphs of polynomials and rational functions by analyzing and using the characteristics of zeros, upper and lower bounds, y-intercepts, symmetry, asymptotes and end behavior, maximum and minimum points, and domain and range.	-1	3	The NxG WV objective incorporates technology as a tool.
M.3HS.TF.1 Derive the formula *A* = 1/2 *ab* sin(*C*) for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side.	**M.O.T.3.9** develop and test a hypothesis to find the area of a triangle given the measures of two sides and the included angle or the measures of three sides (Heron''s formula) and use these formulas to find total area of figures constructed of multiple shapes.	-1	3	The NxG WV objective is more specific in the method of derivation.
M.3HS.TF.2 (+) Prove the Laws of Sines and Cosines **and use them to solve problems.** *(With respect to the general case of the Laws of Sines and Cosines, the definitions of sine and cosine must be extended to obtuse angles.)*	**M.O.T.3.8 investigate real-world problems within a project based investigation involving triangles using the trigonometric functions, the law of sines and the law of cosines, justify and present results**.	-1	2	The NxG WV objective expands using the Law of Sines and Cosines to proof.
M.3HS.TF.3 (+) Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems,	**M.O.T.3.8** investigate real-world problems within a project based investigation involving triangles using the trigonometric functions, the law of sines and the law of cosines, justify and present results.	-1	3	There is a strong correlation.

resultant forces).				
M.3HS.TF.4 Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.	**M.O.T.3.2** convert angle measures from degrees to radians (and vice versa) and apply this concept to • create a data set, analyze, and formulate a hypotheses to test and develop formulas for the arc length, area of a sector, and angular velocity and use the formula for application in the real-world. • compare and contrast the concepts of angular velocity and linear velocity and demonstrate by graphical or algebraic means relationship between them and apply to real-world problems.	-1	3	The NxG WV objective stresses the importance of using values from the unit circle.
M.3HS.TF.5 Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to **all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle**.	**M.O.T.3.4** justify and **present the solutions of trigonometric equations that include both infinite and finite (over a restricted domain) solutions**.	-1	3	The NxG WV objective stresses the importance of using the values of the unit circle.
M.3HS.TF.6 Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.★	**M.O.T.3.7** model periodic data sets using graphs, tables, and equations and use them to analyze real-world problems such as electricity and harmonic motion.	-1	3	There is a strong correlation.
M.3HS.MM.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*	**M.O.A1.2.2** create and solve multi-step linear equations, absolute value equations, and linear inequalities in one variable, (with and without technology); apply skills toward solving practical problems such as distance, mixtures or	+2	3	The NxG WV objective expands to quadratic equations.

functions. (Use all available types of functions to create such equations, including root functions, but constrain to simple cases.)	motion and judge the reasonableness of solutions.			
M.3HS.MM.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.*(While functions will often be linear, exponential, or quadratic the types of problems should draw from more complex situations than those addressed in Mathematics I. For example, finding the equation of a line through a given point perpendicular to another line allows one to find the distance from a point to a line.)*	**M.O.A1.2.8** identify a real life situation that involves a constant rate of change; pose a question; make a hypothesis as to the answer; develop, justify, and implement a method to collect, organize, and analyze related data; extend the nature of collected, discrete data to that of a continuous linear function that describes the known data set; **generalize the results to make a conclusion**; compare the hypothesis and the conclusion; **present** the project numerically, analytically, **graphically** and verbally using the predictive and analytic tools of algebra (with and without technology).	+2	1	The NxG WV objective expands to three or more variables.
	M.O.A2.2.15 identify a real life situation that exhibits characteristics of change that can be modeled by a quadratic equations; pose a questions; make a hypothesis as to the answer; develop, justify, and implement a method to collect, organize and analyze related data; extend the nature of collected, discrete data to that of a continuous function that describes the known data set; generalize the results to make a conclusion; **compare the hypothesis** and the conclusion; **present** the project numerically, analytically, **graphically** and	0	2	The NxG WV objective expands to three or more variables.

	verbally using the predictive and analytic tools of algebra (with and without technology).			
M.3HS.MM.3 Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.*	**M.O.A2.2.10** solve and graph the solution set of systems of linear inequalities in two variables by finding the maximum or minimum values of a function over the feasible region using linear programming techniques.	0	3	There is a strong correlation.
M.3HS.MM.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. (The example given applies to earlier instances of this standard, not to the current course.)*	**M.O.A1.2.3** evaluate data provided, given a real-world situation, select an appropriate literal equation and solve for a needed variable.	+2	3	There is a strong correlation.
M.3HS.MM.5 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features **given a verbal description of the relationship**. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums;*	**M.O.A1.2.7 analyze situations and solve problems by determining the equation of a line given a graph of a line**, two points on the line, the slope and a point, or the slope and y intercept.	+2	1	The NxG WV objective expands to higher order equations.
	M.O.A1.2.15 describe real life situations involving exponential growth and decay equations including $y=2^x$ and $y=(½)^x$; compare the equation with attributes of an **associated table and graph to demonstrate an understanding of their**	+2	1	The NxG WV objective expands to higher order equations.

symmetries; end behavior; and periodicity.★ (Emphasize the selection of a model function based on behavior of data and context.)	**interrelationship**.			
	M.O.PC.2.1 investigate and sketch the graphs of polynomials and rational functions by analyzing and using the characteristics of zeros, upper and lower bounds, y-intercepts, symmetry, asymptotes and end behavior, maximum and minimum points, and domain and range.	-1	3	There is a strong correlation.
M.3HS.MM.6 Relate the **domain of a function** to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.★*	**M.O.A2.2.7** define a function and find its zeros; **express the domain** and range using interval notation; find the inverse of a function; find the value of a function for a given element in its domain; and perform basic operations on functions including composition of functions.	0	2	The NxG WV objective expands to relate the domain to the quantitative relationship it describes.
M.3HS.MM.7 Calculate and interpret the average **rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph**.★	**M.O.A1.2.8 identify a real life situation that involves** a constant **rate of change; pose a question; make a hypothesis as to the answer**; develop, justify, and implement a method to collect, organize, and analyze related data; extend the nature of collected, discrete data to that of a continuous linear function that describes the known data set; generalize the results to make a conclusion; compare the hypothesis and the conclusion; present the project numerically, analytically, graphically and verbally using the predictive and analytic tools of algebra (with and without technology).	+2	2	The NxG WV objective expands to average rate of change and higher order equations.

M.3HS.MM.8 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.★ a. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. *b.* b. **Graph exponential and logarithmic functions**, **showing intercepts and end behavior**, and **trigonometric functions, showing period, midline and amplitude**. *(Focus on applications and how key features relate to characteristics of a situation, making selection of a particular type of function model appropriate.)*	**M.O.PC.2.1 investigate and sketch the graphs** of polynomials and rational functions **by analyzing and using the characteristics of zeros, upper and lower bounds, y-intercepts, symmetry, asymptotes and end behavior, maximum and minimum points, and domain and range**.	-1	1	The NxG WV objective incorporates technology as a tool and expands to square root, cube root, piecewise, step, absolute value, exponential, logarithmic and trigonometric functions.
	M.O.A1.2.15 describe real life situations involving exponential growth and decay equations including **$y=2^x$ and $y=(½)^x$; compare the equation** with attributes of an associated table and **graph to demonstrate an understanding** of their interrelationship.	+2	1	The NxG WV objective incorporates technology as a tool and expands to square root, cube root, piecewise, step, absolute value and trigonometric functions.
	M.O.A2.2.8 analyze families of functions and their transformations; recognize linear, quadratic, radical, absolute value, step, piece-wise, and exponential functions; analyze connections among words, graphs, tables and equations when solving practical problems with and without technology.	0	3	The NxG WV objective expands to trigonometric functions.
	M.O.T.3.7 model periodic data sets using graphs, tables, and equations and use them to analyze real-world problems such as electricity and harmonic motion.	-1	1	The NxG WV objective incorporates technology as a tool and expands to square root, cube root, piecewise, step, absolute value, exponential, and logarithmic functions.
	M.O.PC.2.4 establish and explain the inverse relationship between exponential and logarithmic functions; **graph related functions** and include their domain and range using interval notation.	-1	1	The NxG WV objective incorporates technology as a tool and expands to square root, cube root, piecewise, step, absolute value and trigonometric functions.
M.3HS.MM.9 Write a function defined by an expression in	**M.O.A2.2.4** simplify expressions involving radicals and fractional	0	1	The NxG WV objective expands to all functions.

different but equivalent forms to reveal and explain different properties of the function.	exponents, **convert between the two forms**, and solve equations containing radicals and exponents.			
	M.O.T.3.3 using various methods, basic identities and graphical representation • **verify trigonometric identities** • prove the sum and difference to two angles, double-angles, and half-angle identities.	-1	1	The NxG WV objective expands to all functions.
M.3HS.MM.10 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.*	**M.O.A1.2.21** use multiple representations, such as words, graphs, tables of values and equations, to solve practical problems; describe advantages and disadvantages of the use of each representation.	+2	3	There is a strong correlation.
	M.O.PC.2.11 use multiple representations, such as words, graphs, tables, and equations, to solve practical problems involving logarithmic, exponential, polynomial, rational, and radical functions; **explain how the representations are related** to each other, as well as to the problem.	-1	3	There is a strong correlation.
M.3HS.MM.11 Write a function that describes a relationship between two quantities.* Combine standard function types using arithmetic operations. *For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the*	**M.O.A2.2.7** define a function and find its zeros; express the domain and range using interval notation; find the inverse of a function; find the value of a function for a given element in its domain; and perform basic operations on functions including composition of functions.	0	3	There is a strong correlation.

model. (Develop models for more complex or sophisticated situations than in previous courses.)				
M.3HS.MM.12 Identify the effect on the graph of replacing ***f(x)* by *f(x) + k, k f(x)***, *f(kx),* and *f(x + k)* for specific values of *k* (both positive and negative); find the value of *k* given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. *Include recognizing even and odd functions from their graphs and algebraic expressions for them. (Use transformations of functions to find more optimum models as students consider increasingly more complex situations. Note the effect of multiple transformations on a single function and the common effect of each transformation across function types. Include functions defined only by graph.)*	**M.O.A2.2.7** define a function and find its zeros; express the domain and range using interval notation; find the inverse of a function; find the value of a function for a given element in its domain; and **perform basic operations on functions** including composition of functions.	0	1	The NxG WV objective relates the parameters of functions to values that determine transformations.
	M.O.A2.2.8 analyze families of functions and their transformations; recognize linear, quadratic, radical, absolute value, step, piece-wise, and exponential functions; analyze connections among words, graphs, tables and equations when solving practical problems with and without technology.	0	3	There is a strong correlation.
	M.O.PC.3.1 graph functions and conic sections using transformations.	-1	3	The NxG WV objective incorporates technology as a tool.
M.3HS.MM.13 Find inverse functions. Solve an equation of the form *f(x) = c* for a simple function *f* that has an inverse and write an expression for the inverse. *For example, f(x) = 2 x3 or f(x) = (x+1)/(x-1) for x ≠ 1(Extend to simple rational, simple radical, and simple exponential functions.)*	**M.O.A2.2.7** define a function and find its zeros; express the domain and range using interval notation; find the inverse of a function; find the value of a function for a given element in its domain; and perform basic operations on functions including composition of functions.	0	3	There is a strong correlation.
	M.O.T.3.5 find the value of the inverse trigonometric functions using special angle trigonometric function values and technology.	-1	1	The NxG WV objective expands to all functions.

	• draw inferences of restricted domain to recognize and produce a graph of the inverse trigonometric functions. • prove conjectures made about the solution of the equations such as x = sin (arcsin y), x = sin (arcos y) being sure to consider restrictions of the domain.			
	M.O.PC.2.4 establish and explain the inverse relationship between exponential and logarithmic functions; graph related functions and include their domain and range using interval notation.	-1	1	The NxG WV objective expands to all functions.
M.3HS.MM.14 For exponential models, express as a logarithm the solution to $a\ b^{ct} = d$ where *a, c*, and *d* are numbers and the base *b* is 2, 10, or *e*; evaluate the logarithm using technology. *(Consider extending this unit to include the relationship between properties of logarithms and properties of exponents, such as the connection between the properties of exponents and the basic logarithm property that log xy = log x + log y.)*	**M.O.PC.2.4** establish and explain the inverse relationship between exponential and logarithmic functions; graph related functions and include their domain and range using interval notation.	-1	3	The NxG WV objective incorporates technology as a tool.
M.3HS.MM.15 Identify the shapes of two-dimensional cross-sections of three dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.	**M.O.G.3.16** derive and justify formulas for area, perimeter, **surface area**, and volume **using nets and apply them to solve real-world problems.**	+1	1	The NxG WV objective expands to identifying three-dimensional objects generated by rotations of two-dimensional objects.
	M.O.A2.2.12 analyze the conic sections; identify and sketch the graphs of a parabola, circle, ellipse,	0	3	There is a strong correlation.

	and hyperbola and convert between graphs and equations.			
M.3HS.MM.16 Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).★			0	
M.3HS.MM.17 Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).★			0	
M.3HS.MM.18 Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).★			0	