KENAI PENINSULA BOROUGH SCHOOL DISTRICT
148 North Binkley Street   Soldotna, Alaska 99669-7553
Phone (907) 714-8888   Fax (907) 262-9132
www.kpbsd.k12.ak.us

SCHOOL BOARD COMMUNICATION

Title:	**Curriculum Updates**		
Date:	**10/08/2012**	**Item Number:**	Worksession
Administrator:	**Doris Cannon, Director of Curriculum** Doris L Cannon **Through Sean Dusek, Assistant Superintendent of Instruction** Sean Dusek		
Attachments:	**2012-13 K-12 Math Curriculum – Rough Draft**		

☐ **Action Needed** ☐ **For Discussion** ☒ **Information** ☐ **Other:** ______________

BACKGROUND INFORMATION

The Math Curriculum Revision Committee has drafted revised curriculum documents based on the new AK Math Standards. The committee developed a materials evaluation sheet and invited three vendors to present their programs. The committee is currently conducting an in-depth review of the programs before making a final recommendation. Once the committee makes a recommendation, an email with links will be sent to all teachers of mathematics for their feedback. In addition, a panel of parents and students will also review the materials and curriculum documents. This is a new strategy as an attempt to get more input from different stakeholders. Questions and comments are welcomed by the Board and will be taken back to the committee for further study if required.

ADMINISTRATIVE RECOMMENDATION

K-12 Math Curriculum

Rough Draft

2012-13

COMMITTEE MEMBERS

Angela Brown	Skyview High School
Brandon Young	Paul Banks Elementary
Breta Brown	Nikiski North Star
Christina Granger	Tustumena Elementary
Cindy Denny	P.D. Homer Area Coach
Cynthia McKibben	Mt. View Elementary
Dan Calhoun	Homer Middle School
Dave Fischer	Kenai Middle School
Dave Michael	Tustumena Elementary
Deanne Pearson	River City Academy
Doris Cannon	Curriculum Director
Jason Bickling	Administrator- Seward
Joseph Pazar	K-Beach Elementary
Kim Johnson	Chapman School
Lacey Wisniewski	Kenai Middle School
Laura Fellows	Homer Middle School
Marty Anderson	School Board Representative
Michelle Fournier	Razdolna School
Ranada Hassemer	Redoubt Elementary
Renee Merkes	Soldotna High School
Scot Akers	Homer High School
Scott Peek	Kenai Central High School
Sherry Matson	Nikiski North Star Elementary
Suzanne Goodwill	Soldotna Middle School
Tim Whip	Administrator- Razdolna
Troy Minogue	Soldotna High School

ELEMENTARY MATH
(K-5)

Curriculum Sequence: Kindergarten

Mathematical Domain	Cluster	Standard	Sequence and Duration
Counting, Cardinality, Ordinality (CC)	Know number names and the count sequence	K.CC.1. Count to 100 by ones and by tens.	1, 2, 3, 4
		K.CC.2. Count forward beginning from a given number within the known sequence.	1, 2, 3, 4
		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).	1, 2, 3
	Count to tell the number of objects	K.CC.4. Understand the relationship between numbers and quantities; connect counting to cardinality. a. When counting objects, say the number names in 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.	1, 2, 3
		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.	1, 2, 3
	Compare numbers	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, counting, or estimating strategies).	1, 2
		K.CC.7. Compare and order two numbers between 1 and 10 presented as written numerals.	3, 4
Operations and Algebraic Thinking (OA)	Understand addition as putting together & adding to, & understand subtraction as taking apart and taking from	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.	2, 3, 4
		K.OA.2. Add or subtract whole numbers to 10 (e.g., by using objects or drawings to solve word problems).	2, 3, 4
		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). *For example, 5 = 2 + 3 and 5 = 4 + 1.*	3, 4

Mathematical Domain	Cluster	Standard	Sequence and Duration
		K.OA.4. For any number from 1-4, find the number that makes 5 when added to the given number and, for any number from 1-9, find the number that makes 10 when added to the given number (e.g., by using objects, drawings or 10 frames) and record the answer with a drawing or equation.	3, 4
		K.OA.5. Fluently add and subtract numbers up to 5.	3, 4
	Identify and continue patterns	K.OA.6. Recognize, identify and continue simple patterns of color, shape, and size.	1, 2
<u>Number and Operations in Base Ten (NBT)</u>	Work with numbers 11-19 to gain foundations for place value	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 and 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.	1, 2, 3, 4
<u>Measurement and Data (MD)</u>	Describe and compare measurable attributes.	K.MD.1. Describe measurable attributes of objects (e.g., length or weight). Match measuring tools to attribute (e.g., ruler to length). Describe several measureable attributes of a single object.	1, 2, 3
		K.MD.2. Make comparisons between 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.*	1, 2
	Classify objects and count the number of objects in each category	K.MD.3. Classify objects into given categories (attributes). Count the number of objects in each category (limit category counts to be less than or equal to 10).	1, 2
	Work with time and money	K.MD.4. Name in sequence the days of the week.	1, 2
		K.MD.5. Tell time to the hour using both analog and digital clocks.	1, 2, 3, 4
		K.MD.6. Identify coins by name.	3, 4
<u>Geometry (G)</u>	Identify and describe shapes (squares, circles, triangles, rectangles, hexagons, cubes, cones, cylinders, and spheres	K.G.1. Describe objects in the environment using names of shapes and describe their relative positions (e.g., *above*, *below*, *beside*, *in front of*, *behind*, *next to)*.	1, 2
		K.G.2. Name shapes regardless of their orientation or overall size.	1, 2
		K.G.3. Identify shapes as two-dimensional (flat) or three-dimensional (solid).	2, 3, 4
	Analyze, compare,	K.G.4. Analyze and compare two- and three-dimensional	2, 3, 4

Mathematical Domain	Cluster	Standard	Sequence and Duration
	create, and compose shapes	shapes, in different sizes and orientations, using informal language to describe their similarities, differences, parts (e.g., number of sides and vertices), and other attributes (e.g., having sides of equal lengths).	
		K.G.5. Build shapes (e.g., using sticks and clay) and draw shapes.	2, 3, 4
		K.G.6. Put together two-dimensional shapes to form larger shapes (e.g., join two triangles with full sides touching to make a rectangle).	2, 3, 4

Curriculum Sequence: First Grade

Mathematical Domain	Cluster	Standard	Sequence and Duration
Counting, Cardinality, Ordinality (CC)	Skip count and know ordinal names	1.CC.1. Skip count by 2s and 5s.	1, 2
		1.CC.2. Use ordinal numbers correctly when identifying object position (e.g., first, second, third, etc.).	1, 2
	Count to tell the number of objects	1.CC.3. Order numbers from 1-100. Demonstrate ability in counting forward and backward.	1, 2
		1.CC.4. Count a large quantity of objects by grouping into 10s and counting by 10s and 1s to find the quantity.	1, 2
	Compare numbers	1.CC.5. Use the symbols for greater than, less than or equal to when comparing two numbers or groups of objects.	1, 2
		1.CC.6. Estimate how many and how much in a given set to 20 and then verify estimate by counting.	2
Operations and Algebraic Thinking (OA)	Represent and solve problems involving addition and subtraction	1.OA.1. Use addition and subtraction strategies to solve word problems (using numbers up to 20), involving situations of adding to, taking from, putting together, taking apart and comparing, with unknowns in all positions, using a number line (e.g., by using objects, drawings and equations). Record and explain using equation symbols and a symbol for the unknown number to represent the problem.	2, 3
		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). Record and explain using equation symbols and a symbol for the unknown number to represent the problem.	2, 3
	Understand and apply properties of operations and the relationship between addition and subtraction	1.OA.3. Apply properties of operations as strategies to add and subtract. (Students need not know the name of the property.) *For example: 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). Demonstrate that when adding zero to any number, the quantity does not change (Identity property of addition).*	2
		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*	2, 3
	Add and subtract using numbers up to 20	1.OA.5. Relate counting to addition and subtraction (e.g., by counting on 2 to add 2).	2
		1.OA.6. Add and subtract using numbers up to 20, demonstrating fluency for addition and subtraction up to 10. Use strategies such as •counting on •making ten (8 + 6 = 8 + 2 + 4 =	2, 3

Mathematical Domain	Cluster	Standard	Sequence and Duration
		10 + 4 = 14) •decomposing a number leading to a ten (13 - 4 = 13 - 3 -1 = 10 - 1 = 9) •using the relationship between addition and subtraction, such as fact families, (8 + 4 = 12 and 12 - 8 = 4) •creating equivalent but easier or known sums (e.g., adding 6 + 7 by creating the known equivalent 6 + 6 + 1 = 12 + 1 = 13).	
	Work with addition and subtraction equations	1.OA.7. Understand the meaning of the equal sign (e.g., read equal sign as "same as") 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)*	2
		1.OA.8. Determine the unknown whole number in an addition or subtraction equation. *For example, determine the unknown number that makes the equation true in each of the equations 8 + ? = 11, 6 + 6 = ?, 5 = ? - 3.*	2
	Identify and continue patterns	1.OA.9. Identify, continue and label patterns (e.g., aabb, abab). Create patterns using number, shape, size, rhythm or color.	1
<u>Number and Operation in Base Ten (NBT)</u>	Extend the counting sequence	1.NBT.1. Count to 120. In this range, read, write and order numerals and represent a number of objects with a written numeral.	1, 2, 3
	Understand place value	1.NBT.2. Model and identify place value positions of two digit numbers. Include: a. 10 can be thought of as a bundle of ten ones, called a "ten". 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).	2, 3
		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 >, =, <.	2, 3
	Use place value understanding and properties of operations to add and subtract	1.NBT.4. Add using numbers up to 100 including adding a two-digit number and a one-digit number and adding a two-digit number and a multiple of 10. Use: • concrete models or drawings and strategies based on place value • properties of operations • and/or relationship between addition and subtraction; Relate the strategy to a written method and explain the reasoning used. Demonstrate in adding two-digit numbers, tens and tens are added, ones and ones are added and sometimes it is necessary to compose a ten from ten ones.	3, 4

Mathematical Domain	Cluster	Standard	Sequence and Duration
		1.NBT.5. Given a two-digit number, mentally find 10 more or 10 less than the number, without having to count; explain the reasoning used.	3, 4
		1.NBT.6. Subtract multiples of 10 up to 100. Use: • concrete models or drawings • 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.	3, 4
<u>Measurement and Data (MD)</u>	Measure lengths indirectly and be iterating length units	1.MD.1. Measure and compare three objects using standard or non-standard units.	1
		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.	1
	Tell and write time and work with money	1.MD.3. Tell and write time in half hours using both analog and digital clocks.	1, 2, 3
		1.MD.4. Read a calendar distinguishing yesterday, today and tomorrow. Read and write a date.	1, 2, 3
		1.MD.5. Recognize and read money symbols including $ and ¢.	3
		1.MD.6. Identify values of coins (e.g., nickel = 5 cents, quarter = 25 cents). Identify equivalent values of coins up to $1 (e.g., 5 pennies = 1 nickel, 5 nickels = 1 quarter).	3, 4
	Represent and interpret data	1.MD. 7. Organize, represent and interpret data with up to three categories. Ask and answer comparison and quantity questions about the data.	3, 4
<u>Geometry (G)</u>	Reason with shapes and their attributes	1.G.1. Distinguish between defining attributes (e.g., triangles are closed and three-sided) versus non-defining attributes. Identify shapes that have non-defining attribute (e.g., color, orientation, overall size). Build and draw shapes given specified attributes.	4
		1.G.2. Compose (put together) two-dimensional or three-dimensional shapes to create a larger, composite shape, and compose new shapes from the composite shape.	4
		1.G.3. Partition circles and rectangles into two and four equal shares. Describe the shares using the words*, halves, fourths*, and *quarters* and 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 (break apart) into more equal shares creates smaller shares.	4

Curriculum Sequence: Second Grade

Mathematical Domain	Cluster	Standard	Sequence and Duration
Operations and Algebraic Thinking (OA)	Represent and solve problems involving addition and subtraction	2.OA.1. Use addition and subtraction strategies to estimate, then solve one- and two step word problems (using numbers up to 100) 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). Record and explain using equation symbols and a symbol for the unknown number to represent the problem.	1, 2, 3
	Add and subtract using numbers up to 20	2.OA.2. Fluently add and subtract using numbers up to 20 using mental strategies. Know from memory all sums of two one-digit numbers.	1
	Work with equal groups of objects to gain foundations for multiplication	2.OA.3. Determine whether a group of objects (up to 20) is odd or even (e.g., by pairing objects and comparing, counting by 2s). Model an even number as two equal groups of objects and then write an equation as a sum of two equal addends.	1
		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 repeated addition (e.g., array of 4 by 5 would be 5 + 5 + 5 + 5 = 20).	4
	Identify and continue patterns	2.OA.5. Identify, continue and label number patterns (e.g., aabb, abab). Describe a rule that determines and continues a sequence or pattern.	1
Number and Operations in Base Ten (NBT)	Understand place value	2.NBT.1. Model and identify place value positions of three digit numbers. Include: 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).	1, 2
		2.NBT.2. Count up to 1000, skip-count by 5s, 10s and 100s.	1, 2
		2.NBT.3. Read, write, order up to 1000 using base-ten numerals, number names and expanded form.	1, 2
		2.NBT.4. Compare two three-digit numbers based on the meanings of the hundreds, tens and ones digits, using >, =, < symbols to record the results.	2
	Use place value understanding and properties of operations to add and subtract	2.NBT.5. Fluently add and subtract using numbers up to 100. Use: * strategies based on place value *properties of operations * and/or the relationship between	2, 3

Mathematical Domain	Cluster	Standard	Sequence and Duration
		addition and subtraction.	
		2.NBT.6. Add up to four two-digit numbers using strategies based on place value and properties of operations.	3, 4
		2.NBT.7. Add and subtract using numbers up to 1000. Use: *concrete models or drawings and strategies based on place value *properties of operations *and/or relationship between addition and subtraction. Relate the strategy to a written method and explain the reasoning used. Demonstrate in adding or subtracting three digit numbers, hundreds and hundreds are added or subtracted, tens and tens are added or subtracted, ones and ones are added or subtracted and sometimes it is necessary to compose a ten from ten ones or a hundred from ten tens.	3, 4
		2.NBT.8. Mentally add 10 or 100 to a given number 100-900 and mentally subtract 10 or 100 from a given number.	2, 3
		2.NBT.9. Explain or illustrate the processes of addition or subtraction and their relationship using place value and the properties of operations.	2, 3, 4
<u>Measurement and Data (MD)</u>	Measure and estimate lengths in standard units	2.MD.1. Measure the length of an object by selecting and using standard tools such as rulers, yardsticks, meter sticks, and measuring tapes.	1
		2.MD.2. Measure the length of an object twice using different length units for the two measurements. Describe how the two measurements relate to the size of the unit chosen.	1
		2.MD.3. Estimate, measure and draw lengths using whole units of inches, feet, yards, centimeters and meters.	1
		2.MD.4. Measure to compare lengths of two objects, expressing the difference in terms of a standard length unit.	1
	Relate addition and subtraction to length	2.MD.5. Solve addition and subtraction word problems using numbers up to 100 involving length that are given in the same units (e.g., by using drawings of rulers). Write an equation with a symbol for the unknown to represent the problem.	2, 3
		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.	2, 3
	Work with time and money	2.MD.7. Tell and write time to the nearest five minutes using a.m. and p.m. from analog and digital clocks.	1, 2, 3

Mathematical Domain	Cluster	Standard	Sequence and Duration
		2.MD.8. Solve word problems involving dollar bills and coins using the $ and ¢ symbols appropriately.	2, 3, 4
	Represent and interpret data	2.MD.9. Collect, record, interpret, represent, and describe data in a table, graph or line plot.	3, 4
		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.	3, 4
Geometry (G)	Reason with shapes and their attributes	2.G.1. Identify and draw shapes having specified attributes, such as a given number of angles or a given number of equal faces compared visually, not by measuring. Identify triangles, quadrilaterals, pentagons, hexagons and cubes.	4
		2.G.2. Partition a rectangle into rows and columns of same-size squares and count to find the total number of them.	4
		2.G.3. Partition circles and rectangles into 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.	4

Curriculum Sequence: Third Grade

Mathematical Domain	Cluster	Standard	Sequence and Duration
Operations and Algebraic Thinking (OA)	Represent and solve problems involving multiplication and division	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, show objects in rectangular arrays or describe a context in which a total number of objects can be expressed as 5 × 7.*	1
		3.OA.2. Interpret whole-number quotients of whole numbers (e.g., interpret 56 ÷ 8 as the number of objects in each share when 56 objects are partitioned equally into 8 shares, or as a number of shares when 56 objects are partitioned into equal shares of 8 objects each). *For example, deconstruct rectangular arrays or describe a context in which a number of shares or a number of groups can be expressed as 56 ÷ 8.*	1
		3.OA.3. Use multiplication and division numbers up to 100 to solve word problems in situations involving equal groups, arrays, and measurement quantities (e.g., by using drawings and equations with a symbol for the unknown number to represent the problem).	1, 2, 3
		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 x ? = 48, 5 = ? ÷ 3, 6 x 6 = ?*	1, 2, 3
	Understand properties of multiplication and the relationship between multiplication and division	3.OA.5. Make, test, support, draw conclusions and justify conjectures about properties of operations as strategies to multiply and divide. (Students need not use formal terms for these properties.) *Commutative property of multiplication: If 6 × 4 = 24 is known, then 4 × 6 = 24 is also known. *Associative 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. *Distributive property: 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. *Inverse property (relationship) of multiplication and division.	1, 2, 3
		3.OA.6. Understand division as an unknown factor problem. *For example, find 32 ÷ 8 by finding the number that makes 32 when multiplied by 8.*	1, 2, 3, 4
	Multiply and divide up to 100	3.OA.7. Fluently multiply and divide numbers up to 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.	1, 2, 3, 4

Mathematical Domain	Cluster	Standard	Sequence and Duration
	Solve problems involving the four operations, and identify and explain patterns in arithmetic	3.OA.8. Solve and create two-step word problems using any of the four operations. Represent these problems using equations with a symbol (box, circle, question mark) standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding.	3, 4
		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.*	1, 2
<u>Number and Operations in Base Ten (NBT)</u>	Use place value understanding and properties of operations to perform multi-digit arithmetic	3.NBT.1. Use place value understanding to round whole numbers to the nearest 10 or 100.	1
		3.NBT.2. Use strategies and/or algorithms to fluently add and subtract with numbers up to 1000, demonstrating understanding of place value, properties of operations, and/or the relationship between addition and subtraction.	1
		3.NBT.3. Multiply one-digit whole numbers by multiples of 10 in the range 10-90 (e.g., 9 x 80, 10 x 60) using strategies based on place value and properties of operations.	1, 2
<u>Number and Operations-Fractions (NF) (limited in this grade to fractions with denominators 2,3,4,6, 8)</u>	Develop understanding of fractions as numbers	3.NF.1. Understand a fraction 1/*b* (e.g., 1/4) as the quantity formed by 1 part when a whole is partitioned into *b* (e.g., 4) equal parts; understand a fraction *a*/*b* (e.g., 2/4) as the quantity formed by *a* (e.g., 2) parts of size 1/*b*. (e.g., 1/4)	2
		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* (e.g., 1/4) on a number line diagram by defining the interval from 0 to 1 as the whole and partitioning it into *b* (e.g., 4) equal parts. Recognize that each part has size 1/*b* (e.g., 1/4) and that the endpoint of the part based at 0 locates the number 1/*b* (e.g., 1/4) on the number line. b. Represent a fraction *a*/*b* (e.g., 2/8) on a number line diagram or ruler by marking off *a* lengths 1/*b* (e.g., 1/8) from 0. Recognize that the resulting interval has size *a*/*b* (e.g., 2/8) and that its endpoint locates the number *a*/*b* (e.g., 2/8) on the number line.	2
		3.NF.3. Explain equivalence of fractions in special cases, and compare fractions by reasoning about their size. a. Understand two fractions as equivalent if they are the same size (modeled) or the same point on a number line. b. Recognize and generate simple equivalent fractions	2, 3

Mathematical Domain	Cluster	Standard	Sequence and Duration
		(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 and model whole numbers as fractions, and recognize and construct fractions that are equivalent to whole numbers. *For example: Express 3 in the form 3 = 3/1; recognize that 6/1 = 6; locate 4/4 and 1 at the same point of a number line diagram.* d. Compare two fractions with the same numerator or the same denominator by reasoning about their size. Recognize that comparisons are valid only when the two fractions refer to the same whole. Record the results of comparisons with the symbols >, =, or <, and justify the conclusions (e.g., by using a visual fraction model).	
<u>Measurement and data (MD)</u>	Solve problems involving measurement and estimation of intervals of time, liquid, volumes, and masses of objects	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 or hours (e.g., by representing the problem on a number line diagram or clock).	3, 4
		3.MD.2. Estimate and measure liquid volumes and masses of objects using standard units of grams (g), kilograms (kg), and liters (l). (Excludes compound units such as cm3 and finding the geometric volume of a container.) Add, subtract, multiply, or divide to solve and create 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). (Excludes multiplicative comparison problems [problems involving notions of "times as much."])	3, 4
		3.MD.3. Select an appropriate unit of English, metric, or non-standard measurement to estimate the length, time, weight, or temperature (L)	1
	Represent and interpret data	3.MD.4. 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.*	1, 2
		3.MD.5. Measure and record lengths using rulers marked with halves and fourths of an inch. Make a line plot with the data, where the horizontal scale is marked off in appropriate units—whole numbers, halves, or quarters.	2
		3.MD.6. Explain the classification of data from real-world problems shown in graphical representations. Use the terms minimum and maximum. (L)	1, 2, 3, 4
	Geometric measurement:	3.MD.7. Recognize area as an attribute of plane figures and understand concepts of area measurement.	3

Mathematical Domain	Cluster	Standard	Sequence and Duration
	understand concepts of area and relate area to multiplication and to addition	a. A square with side length 1 unit is said to have “one square unit” and can be used to measure area. b. Demonstrate that a plane figure which can be covered without gaps or overlaps by *n* (e.g., 6) unit squares is said to have an area of *n* (e.g., 6) square units.	
		3.MD.8. Measure areas by tiling with unit squares (square centimeters, square meters, square inches, square feet, and improvised units).	3
		3.MD.9. 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*. For example, after tiling rectangles, develop a rule for finding the area of any rectangle.* 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 wholenumber products as rectangular areas in mathematical reasoning. c. Use area models (rectangular arrays) to represent the distributive property in mathematical reasoning. Use tiling to show in a concrete case that the area of a rectangle with whole-number side lengths a and $b + c$ is the sum of $a \times b$ and $a \times c$. d. Recognize area as additive. Find areas of rectilinear figures by decomposing them into non-overlapping rectangles and adding the areas of the non overlapping parts, applying this technique to solve real world problems. *For example, the area of a 7 by 8 rectangle can be determined by decomposing it into a 7 by 3 rectangle and a 7 by 5 rectangle.*	3
	Geometric measurement: recognize perimeter as an attribute of plane figures and distinguish between linear and area measures	3.MD.9. 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*. For example, after tiling rectangles, develop a rule for finding the area of any rectangle.* 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 area models (rectangular arrays) to represent the distributive property in mathematical reasoning. Use tiling to show in a concrete case that the area of a rectangle with whole-number side lengths a and $b + c$ is the sum of $a \times b$ and $a \times c$.	3

Mathematical Domain	Cluster	Standard	Sequence and Duration
		d. Recognize area as additive. Find areas of rectilinear figures by decomposing them into non-overlapping rectangles and adding the areas of the non-overlapping parts, applying this technique to solve real world problems. *For example, the area of a 7 by 8 rectangle can be determined by decomposing it into a 7 by 3 rectangle and a 7 by 5 rectangle.*	
Geometry (G)	Reason with shapes and their attributes	3.G.1. Categorize shapes by different attribute classifications and recognize that shared attributes can define a larger category. Generalize to create examples or nonexamples.	2
		3.G.2. Partition shapes into parts with equal areas. Express the area of each part as a unit fraction of the whole. *For example, partition a shape into 4 parts with equal area, and describe the area of each part as 1/4 of the area of the shape.*	2

Curriculum Sequence: Fourth Grade

Mathematical Domain	Cluster	Standard	Sequence and Duration
Operations and Algebraic Thinking OA	Use the four operations with whole numbers to solve problems	4.OA.1. Interpret a multiplication equation as a comparison e.g., interpret 35 = 5 × 7 as a statement that 35 is 5 groups of 7 and 7 groups of 5 (Commutative property). Represent verbal statements of multiplicative comparisons as multiplication equations.	1
		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 or missing numbers in an array). Distinguish multiplicative comparison from additive comparison.	1
		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.	1, 2, 3, 4
	Gain Familiarity with factors and multiples	4.OA.4. *Find all factor pairs for a whole number in the range 1–100. *Explain the correlation/differences between multiples and 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.	1, 2
	Generate and analyze patterns	4.OA.5. Generate a number, shape pattern, table, t-chart, or input/output function that follows a given rule. Identify apparent features of the pattern that were not explicit in the rule itself. Be able to express the pattern in algebraic terms. *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.*	1, 2
		4.OA.6. Extend patterns that use addition, subtraction, multiplication, division or symbols, up to 10 terms, represented by models (function machines), tables, sequences, or in problem situations. (L)	1, 2
Number and Operations in Base Ten NBT	Generalize place value understanding for multi-digit whole numbers	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.*	1
		4.NBT.2. Read and write multi-digit whole numbers using	1, 2

Mathematical Domain	Cluster	Standard	Sequence and Duration
		base-ten numerals, number names, and expanded form. Compare two multi-digit numbers based on the value of the digits in each place, using >, =, and < symbols to record the results of comparisons.	
		4.NBT.3. Use place value understanding to round multi-digit whole numbers to any place using a variety of estimation methods; be able to describe, compare, and contrast solutions	1
	Use place value understanding and properties of operations to perform multi-digit arithmetic	4.NBT.4. Fluently add and subtract multi digit whole numbers using any algorithm. Verify the reasonableness of the results.	1
		4.NBT.5. Multiply a whole number of up to four digits by a one-digit whole number, and multiply two two-digit numbers, using strategies based on place value and the properties of operations. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.	2, 3
		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 he relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.	2, 3
<u>Number and Operations – Fractions (Limited in this grade to fractions with denominators 2,3,4,5,6,7,8,10,12, 100)</u>	Extend understanding of fraction equivalence and ordering.	4.NF.1. Explain why a fraction a/b is equivalent to a fraction $(n \times a)/(n \times b)$ 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.	1
		4.NF.2. Compare two fractions with different numerators and different denominators (e.g., by creating common denominators or numerators, or by comparing to a benchmark fraction such as 1/2). Recognize that comparisons are valid only when the two fractions refer to the same whole. Record the results of comparisons with symbols >, =, or <, and justify the conclusions (e.g., by using a visual fraction model).	1, 2
	Build fractions from unit fractions by applying and extending previous understandings of operations on whole	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	1, 2 (a, b), 3 (c, d)

Mathematical Domain	Cluster	Standard	Sequence and Duration
	numbers	decomposition by an equation. Justify decompositions (e.g., by using a visual fraction model). *For example: 3/8 = 1/8 + 1/8 + 1/8 ;3/8 = 1/8 + 2/8 ; 2 1/8 = 1 + 1 + 1/8 = 8/8 + 8/8 + 1/8.* c. Add and subtract mixed numbers with like denominators (e.g., by replacing each mixed number with an equivalent fraction, and/or by using properties of operations and the relationship between addition and subtraction). d. Solve word problems involving addition and subtraction of fractions referring to the same whole and having like denominators (e.g., by using visual fraction models and equations to represent the problem).	
		4.NF.4. Apply and extend previous understandings of multiplication to multiply a fraction by a whole number. 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). Check for the reasonableness of the answer. *For example, if each person at a party will eat 3/8 of a pound of roast beef, and there will be 5 people at the party, how many pounds of roast beef will be needed? Between what two whole numbers does your answer lie?*	2, 3
	Understanding decimal notation for fractions, and compare decimal fractions	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. *For example, express 3/10 as 30/100, and add 3/10 + 4/100 = 34/100.*	1
		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.*	2
		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).	2
<u>Measurement and Data MD</u>	Solve problems involving measurement	4.MD.1. Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz.; l, ml;	3, 4

Mathematical Domain	Cluster	Standard	Sequence and Duration
	and conversion of measurements from a larger unit to a smaller unit, and time	hr, min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit. Record measurement equivalents in a two-column table. *For example, know that 1 ft is 12 times as long as 1 in. Express the length of a 4-ft snake as 48 in. Generate a conversion table for feet and inches listing the number pairs (1, 12), (2, 24), (3, 36).*	
		4.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.	1, 2, 3, 4
		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.*	3
		4.MD.4. Solve real-world problems involving elapsed time between U.S. time zones (including Alaska Standard time). (L)	4
	Represent and interpret data	4.MD.5. 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.*	2, 3
		4.MD.6. Explain the classification of data from real-world problems shown in graphical representations including the use of terms range and mode with a given set of data. (L)	3, 4
	Geometric measurement: understand concepts of angle and measure angles	4.MD.7. Recognize angles as geometric shapes that are formed wherever two rays share a common endpoint, and understand the following 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.	3, 4
		4.MD.8. Measure and draw angles in whole number degrees using a protractor. Estimate and sketch angles of specified measure.	3, 4

Mathematical Domain	Cluster	Standard	Sequence and Duration
		4.MD.9. Recognize angle measure as additive. When an angle is divided 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).	3, 4
Geometry G	Draw and identify lines and angles, and classify shapes by properties of their lines and angles	4.G.1. Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular, parallel, and intersecting line segments. Identify these in two-dimensional (plane) figures.	3
		4.G.2. Classify two-dimensional (plane) 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.	3
		4.G.3. Recognize a line of symmetry for a two dimensional (plane) 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.	3

Curriculum Sequence: Fifth Grade

Mathematical Domain	Cluster	Standard	Sequence and Duration
Operations and Algebraic Thinking (OA)	Write and interpret numerical expressions	5.OA.1. Use parentheses to construct numerical expressions, and evaluate numerical expressions with these symbols.	1
		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 x (8 + 7). Recognizing that 3 x (18932 + 921) is three times as large as 18932 + 921, without having to calculate the indicated sum or product.*	1
	Analyze patterns and relationships	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.*	1
Number and Operations in Base Ten (NBT)	Understand the place value system	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.	1
		5.NBT.2. Explain and extend the patterns in the number of zeros of the product when multiplying a number by powers of 10, and explain and extend the 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.	1
		5.NBT.3. Read, write, and compare decimals to thousandths. a. Read and write decimals to thousandths using base-ten numerals, number names, and expanded form [e.g., 347.392 = 3 x 100 + 4 x 10 + 7 x 1 + 3 (1/10) + 9 (1/100) + 2 (1/1000)]. b. Compare two decimals to thousandths place based on meanings of the digits in each place, using >, =, and < symbols to record the results of comparisons.	1, 2
		5.NBT.4. Use place values understanding to round decimals to any place.	1, 2
	Perform operations with multi-digit whole	5.NBT.5. Fluently multiply multi-digit whole numbers using a standard algorithm.	2

Mathematical Domain	Cluster	Standard	Sequence and Duration
	numbers and with decimals to hundredths		
		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, number lines, real life situations, and/or area models.	2, 3
		5.NBT.7. Add, subtract, multiply, and divide decimals to hundredths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between the operations. Relate the strategy to a written method and explain their reasoning in getting their answers.	2, 3, 4
<u>Number and Operations – Fractions (NF)</u>	Use equivalent fractions as a strategy to add and subtract fractions	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.)*	2, 3
		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 check the reasonableness of answers. *For example, recognize an incorrect result 2/5 + 1/2 = 3/7, by observing that 3/7 < 1/2.*	2, 3
	Apply and extend previous understandings of multiplication and division to multiply and divide fractions	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 of dividing 3 by 4, noting that ¾ 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?*	2, 3
		5.NF.4. Apply and extend previous understandings of multiplication to multiply a fraction or whole number by a fraction. a. Interpret the product $(a/b) \times q$ as a parts of a partition of q into b equal parts; equivalently, as the result of a	2, 3

Mathematical Domain	Cluster	Standard	Sequence and Duration
		sequence of operations $a \times q \div b$. *For example, use a visual fraction model to show (2/3) × 4 = 8/3, and create a story context for this equation. Do the same with (2/3) × (4/5) = 8/15. (In general, (a/b) × (c/d)= ac/bd.)* b. Find the area of a rectangle with fractional side lengths by tiling it with unit squares of the appropriate unit fraction side lengths, and show that the area is the same as would be found by multiplying the side lengths. Multiply fractional side lengths to find areas of rectangles, and represent fraction products as rectangular areas.	
		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. (Division of a fraction by a fraction is not a requirement at this grade.)	2, 3
		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).	2, 3
		5.NF.7. Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions. a. Interpret division of a unit fraction by a nonzero 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 division of whole numbers by unit fractions (e.g., by using visual fraction models and equations to represent the problem). *For example, how much chocolate will each person get if 3 people share 1/2 lb of chocolate equally? How many 1/3-cup servings are in 2 cups of raisins?*	2, 3

Mathematical Domain	Cluster	Standard	Sequence and Duration
Measurement and Data (MD)	Convert like measurement units within a given measurement system. Solve problems involving time	5.MD.1. Identify, estimate measure, and convert equivalent measures within systems English length (inches, feet, yards, miles) weight (ounces, pounds, tons) volume (fluid ounces, cups, pints, quarts, gallons) temperature (Fahrenheit) Metric length (millimeters, centimeters, meters, kilometers) volume (milliliters, liters), temperature (Celsius), (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real world problems using appropriate tools.	3, 4
		5.MD.2. Solve real-world problems involving elapsed time between world time zones. (L)	4
	Represent and interpret data	5.MD.3. 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 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.*	2, 3
		5.MD.4. Explain the classification of data from real-world problems shown in graphical representations including the use of terms mean and median with a given set of data. (L)	3, 4
	Geometric measurement: understand concepts of volume and relate volume to multiplication and to addition	5.MD.5. Recognize volume as an attribute of solid figures and understand concepts of volume measurement. a. A cube with side length 1 unit, called a “unit cube,” is said to have “one cubic unit” of volume, and can be used to measure volume. b. A solid figure that can be packed without gaps or overlaps using *n* unit cubes is said to have a volume of *n* cubic units.	3, 4
		5.MD.6. Estimate and measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft, and non-standard units.	3, 4
		5.MD.7. Relate volume to the operations of multiplication and addition and solve real world and mathematical problems involving volume. a. Estimate and 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. Demonstrate the associative property of multiplication by using the product of three whole numbers to find volumes (length x width x height). b. Apply the formulas $V = l \times w \times h$ and $V = b \times h$ for rectangular prisms to find volumes of right rectangular prisms with whole number edge lengths in the context of solving real world and mathematical problems. c. Recognize volume as additive. Find volumes of solid figures composed of two non-overlapping right rectangular	3, 4

Mathematical Domain	Cluster	Standard	Sequence and Duration
		prisms by adding the volumes of the non-overlapping parts, applying this technique to solve real world problems.	
<u>Geometry (G)</u>	Graph points on the coordinate plane to solve real-world and mathematical problems	5.G.1. Use a pair of perpendicular number lines, called axes, to define a coordinate system, with the intersection of the lines (the origin) arranged to coincide with the 0 on each line and a given point in the plane located by using an ordered pair of numbers, called its coordinates. Understand that the first number indicates how far to travel from the origin in the direction of one axis, and the second number indicates how far to travel in the direction of the second axis, with the convention that the names of the two axes and the coordinates correspond (e.g., *x*-axis and *x*-coordinate, *y*-axis and *y*-coordinate).	3
		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.	3
	Classify two-dimensional figures into categories based on their properties.	5.G.3. Understand that attributes belonging to a category of two dimensional (plane) 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.*	3
		5.G.4. Classify two-dimensional (plane) figures in a hierarchy based on attributes and properties.	3

MIDDLE SCHOOL MATH
(6-8)

Curriculum Sequence: Sixth Grade

Mathematical Domain	Cluster	Standard	Sequence and Duration
Ratios and Proportional Relationships RP	Understand ratio concepts and use ratio reasoning to solve problems	6.RP.1. Write and describe the relationship in real life context between two quantities using ratio language. *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."*	2
		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) and apply it to solve real world problems (e.g., unit pricing, constant speed). *For example, "This recipe has a ratio of 3 cups of flour to 4 cups of sugar, so there is ¾ cup of flour for each cup of sugar." "We paid $75 for 15 hamburgers, which is a rate of $5 per hamburger."*	2
		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 measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios, and understand equivalencies. b. Solve unit rate problems including those involving unit pricing and constant speed. *For example, if it took 7 hours to mow 4 lawns, then at that rate how many lawns could be mowed in 35 hours? At what rate were lawns being mowed?* c. Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity); solve problems involving finding the whole, given a part and the percent. d. Use ratio reasoning to convert measurement units between given measurement systems (e.g., convert kilometers to miles); manipulate and transform units appropriately when multiplying or dividing quantities.	2, 3
The Number System NS	Apply and extend previous understandings of multiplication and division to divide fractions by fractions	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*	1

Mathematical Domain	Cluster	Standard	Sequence and Duration
		rectangular strip of land with length 3/4 mi and area 1/2 square mi?	
	Compute fluently with multi-digit numbers and find common factors and multiples	6.NS.2. Fluently multiply and divide multi digit whole numbers using the standard algorithm. Express the remainder as a whole number, decimal, or simplified fraction; explain or justify your choice based on the context of the problem.	2
		6.NS.3. Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation. Express the remainder as a terminating decimal, or a repeating decimal, or rounded to a designated place value.	2
		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).*	1
	Apply and extend previous understandings of numbers to the system of rational numbers.	6.NS.5 Understand that positive and negative numbers 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, explain the meaning of 0 in each situation.	3
		6.NS.6. Understand a rational number as a point on the number line. Extend number line diagrams and coordinate axes familiar from previous grades to represent points on the line and in the plane with negative number coordinates. a. Recognize opposite signs of numbers as indicating locations on opposite sides of 0 on the number line; Recognize that the opposite of the opposite of a number is the number itself [e.g., –(–3) = 3] and that 0 is its own opposite. b. Understand signs of numbers in ordered pairs as indicating locations in quadrants of the coordinate plane; recognize that when two ordered pairs differ only by signs, the locations of the points are related by reflections across one or both axes. c. Find and position integers and other rational numbers on a horizontal or vertical number line diagram; find and position pairs of integers and other rational numbers on a coordinate plane.	3
		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	3, 4

Mathematical Domain	Cluster	Standard	Sequence and Duration
		diagram. *For example, interpret –3 > –7 as a statement that –3 is located to the right of –7 on a number line oriented from left to right.* b. 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* $\lvert -30 \rvert = 30$ *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 dollar represents a debt greater than 30 dollars.*	
		6.NS.8. Solve real-world and mathematical problems by graphing points in all four quadrants of the coordinate plane. Include use of coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate.	3
<u>Expressions and Equations EE</u>	Apply and extend previous understandings of arithmetic to algebraic expressions	6.EE.1. Write and evaluate numerical expressions involving whole-number exponents. *For example, multiply by powers of 10 and products of numbers using exponents. (73 = 7•7•7)*	1
		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 and formulas. Include formulas used in real-world problems. Perform arithmetic operations, including those involving whole number exponents, in the conventional order with or without parentheses. (Order of Operations)	4
		6.EE.3. Apply the properties of operations to generate equivalent expressions. Model (e.g., manipulatives, graph paper) and apply the distributive, commutative, identity, and inverse properties with integers and variables by writing equivalent expressions. *For example, apply the*	4

Mathematical Domain	Cluster	Standard	Sequence and Duration
		distributive property to the expression 3 (2 + x) to produce the equivalent expression 6 + 3x.	
		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.*	1, 4
	Reason about and solve one-variable equations and inequalities.	6.EE.5. Understand solving an equation or inequality as a process of answering a question: which values from a specified set, if any, make the equation or inequality true? Use substitution to determine whether a given number in a specified set makes an equation or inequality true. *For example: does 5 make 3x > 7 true?*	4
		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.	4
		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.	4
		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.	4
	Represent and analyze quantitative relationships between dependent and independent variables.	6.EE.9. Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation. *For example, in a problem involving motion at constant speed, list and graph ordered pairs of distances and times, and write the equation d = 65t to represent the relationship between distance and time.*	4
<u>Geometry</u>	Solve real-world and mathematical problems involving area, surface area, and volume	6.G.1. Find the area of right triangles, other triangles, special quadrilaterals, and polygons by composing or decomposing into other polygons (e.g., rectangles and triangles). Apply these techniques in the context of solving real-world and mathematical problems.	3, 4
		6.G.2. Apply the standard formulas to find volumes of prisms. Use the attributes and properties (including shapes of bases) of prisms to identify, compare or describe three dimensional figures including prisms and cylinders.	4
		6.G.3. Draw polygons in the coordinate plane given	2

Mathematical Domain	Cluster	Standard	Sequence and Duration
		coordinates for the vertices; determine the length of a side joining the coordinates of vertices with the same first or the same second coordinate. Apply these techniques in the context of solving real-world and mathematical problems.	
		6.G.4. Represent three-dimensional figures (e.g., prisms) 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.	3
		6.G.5. Identify, compare or describe attributes and properties of circles (radius, and diameter). (L)	4
Statistics and Probability SP	Develop understanding of statistical variability	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.*	2, 3
		6.SP.2. Understand that a set of data has a distribution that can be described by its center (mean, median, or mode), spread (range), and overall shape and can be used to answer a statistical question.	2, 3
		6.SP.3. Recognize that a measure of center (mean, median, or mode) for a numerical data set summarizes all of its values with a single number, while a measure of variation (range) describes how its values vary with a single number.	2, 3
	Summarize and describe distributions	6.SP.4. Display numerical data in plots on a number line, including dot or line plots, histograms and box (box and whisker) plots.	2, 3
		6.SP.5. Summarize numerical data sets in relation to their context, such as by: a. Reporting the number of observations (occurrences). 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), as well as describing any overall pattern and any outliers with reference to the context in which the data were gathered. d. Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered.	2, 3
		6.SP.6. Analyze whether a game is mathematically fair or unfair by explaining the probability of all possible outcomes. (L)	2, 3
		6.SP.7. Solve or identify solutions to problems involving possible combinations (e.g., if ice cream sundaes come in 3 flavors with 2 possible toppings, how many different sundaes can be made using only one flavor of ice cream with one topping?) (L)	2, 3

Curriculum Sequence: Seventh Grade

Mathematical Domain	Cluster	Standard	Sequence and Duration
<u>Ratios and Proportional Relationships (RP)</u>	Analyze proportional relationships and use them to solve real-world and mathematical	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 or apply a given scale factor to find missing dimensions of similar figures.*	3
		7.RP.2. Recognize and represent proportional relationships between quantities. Make basic inferences or logical predictions from proportional relationships. a. Decide whether two quantities are in a 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 in real world situations. c. Represent proportional relationships by equations and multiple representations such as tables, graphs, diagrams, sequences, and contextual situations. *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. Understand the concept of unit rate and show it on a coordinate plane. 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.	3
		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.*	3
<u>The Number System (NS)</u>	Apply and extend previous understandings of multiplication and division to divide fractions by fractions	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. Show that a number and its opposite have a sum of 0 (additive inverses). Describe situations in which opposite quantities combine to make 0. *For example, a hydrogen atom has 0 charge because its two constituents are*	1

Mathematical Domain	Cluster	Standard	Sequence and Duration
		oppositely charged. b. Understand addition of rational numbers (*p* + *q* as the number located a distance |*q*| from *p*, in the positive or negative direction depending on whether *q* is positive or negative). 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.	
	Compute fluently with multi-digit numbers and find common factors and multiples	7.NS.2. Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers and use equivalent representations. a. Understand that multiplication is extended from fractions to rational numbers by requiring that operations continue to satisfy the properties of operations, particularly the distributive property, leading to products such as (1)(–1) = 1 and the rules for multiplying signed numbers. Interpret products of rational numbers by describing real world contexts. b. Understand that integers can be divided, provided that the divisor is not zero, and every quotient of integers (with non-zero divisor) is a rational number. If *p* and *q* are integers, then –(*p*/*q*) = (–*p*)/*q* = *p*/(–*q*). Interpret quotients of rational numbers by describing real-world contexts. c. Apply and name properties of operations used as strategies to multiply and divide rational numbers. d. Convert a rational number to a decimal using long division; know that the decimal form of a rational number terminates in 0s or eventually repeats. e. Convert between equivalent fractions, decimals, or percents.	1
		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.) *For example, use models, explanations, number lines, real life situations, describing or illustrating the effect of arithmetic operations on rational numbers (fractions, decimals).*	1
<u>Expressions and Equations (EE)</u>	Apply and extend previous understandings of arithmetic to algebraic expressions	7.EE.1. Apply properties of operations as strategies to add, subtract, factor, expand and simplify linear expressions with rational coefficients.	2
		7.EE.2. Understand that rewriting an	2

Mathematical Domain	Cluster	Standard	Sequence and Duration
		expression in different forms in a problem context can shed light on the problem and how the quantities in it are related. *For example, a + 0.05a = 1.05a means that "increase by 5%" is the same as "multiply by 1.05."*	
		7.EE.3. Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form and assess the reasonableness of answers using mental computation and estimation strategies. *For example: If a woman making $25 an hour gets a 10% raise, she will make an additional 1/10 of her salary an hour, or $2.50, for a new salary of $27.50. If you want to place a towel bar 9 3/4 inches long in the center of a door that is 27 1/2 inches wide, you will need to place the bar about 9 inches from each edge; this estimate can be used as a check on the exact computation.*	2
		7.EE.4. Use variables to represent quantities in a real-world or mathematical problem, and construct multi-step 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. *For example, the perimeter of a rectangle is 54 cm. Its length is 6 cm. What is its width?* b. Solve word problems leading to inequalities of the form $px + q > r$ or $px + q < r$, where p, q, and r are specific rational numbers. Graph the solution set of the inequality and interpret it in the context of the problem. *For example: As a salesperson, you are paid $50 per week plus $3 per sale. This week you want your pay to be at least $100. Write an inequality for the number of sales you need to make, and describe the solutions.*	2
<u>Geometry (G)</u>	Solve real-world and mathematical problems involving area, surface area, and volume	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.	3
		7.G.2. Draw (freehand, with ruler and protractor, and with technology) geometric shapes including polygons and circles with given conditions. Focus on constructing triangles from three measures of angles or sides, noticing when the conditions determine a unique triangle, more than one triangle, or no triangle.	3
		7.G.3. Describe the two-dimensional figures, i.e., cross-section, that result from slicing three-dimensional figures, as in plane sections of right rectangular prisms and right	3

Mathematical Domain	Cluster	Standard	Sequence and Duration
		rectangular pyramids.	
		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.	3
		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.	3
<u>Statistics and Probability (SP)</u>	Develop understanding of statistical variability	7.SP.1. Understand that statistics can be used to gain information about a population by examining a reasonably sized 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.	4
		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 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.*	4
		7.SP.3. Informally assess the degree of visual overlap of two numerical data distributions with similar variabilities, measuring the difference between the centers by expressing it as a multiple of a measure of variability. *For example, the mean height of players on the basketball team is 10 cm greater than the mean height of players on the soccer team, about twice the variability (mean absolute deviation) on either team; on a dot plot, the separation between the two distributions of heights is noticeable.*	4
	Summarize and describe distributions	7.SP.4. Use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations. *For example, decide whether the words in a chapter of a seventh-grade science book are generally longer than the words in a chapter of a fourth-grade science book.*	4
		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.	4

Mathematical Domain	Cluster	Standard	Sequence and Duration
		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.*	4
		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. Design a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events. *For example, if a student is selected at random from a class, find the probability that Jane will be selected and the probability that a girl will be selected.* b. Design 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?*	4

Curriculum Sequence: Eighth Grade (Adv 7th, 8th or Pre-Algebra 9th)

Mathematical Domain	**Cluster**	**Standard**	**Sequence and Duration**
<u>The Number System (NS)</u>	Know that there are numbers that are not rational, and approximate them by rational numbers	8.NS.1. Classify real numbers as either rational (the ratio of two integers, a terminating decimal number, or a repeating decimal number) or irrational.	1
		8.NS.2. Order real numbers, using approximations of irrational numbers, locating them on a number line. *For example, show that √2 is between 1 and 2, then between 1.4 and 1.5, and explain how to continue on to get better approximations.*	1
		8.NS.3. Identify or write the prime factorization of a number using exponents. (L)	1
<u>Expressions and Equations (EE)</u>	Work with radicals and integer exponents	8.EE.1. Apply the properties (product, quotient, power, zero, negative exponents, and rational exponents) of integer exponents to generate equivalent numerical expressions. *For example, 32 × 3–5 = 3–3 = 1/33 = 1/27.*	1
		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.	1
		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 × 108 and the population of the world as 7 × 109, and determine that the world population is more than 20 times larger.*	1
		8.EE.4. Perform operations with numbers expressed in scientific notation, including problems where both standard notation and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities. Interpret scientific notation that has been generated by technology.	1
	Understand the connections between proportional relationships, lines, and linear equations	8.EE.5. Graph linear equations such as *y* = *mx* + *b*, interpreting *m* as the slope or rate of change of the graph and *b* as the *y* intercept or starting value. 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.*	2
	Use similar triangles to explain why the slope is	8.EE.6. Use similar triangles to explain why the slope *m* is the same between any two distinct points on a non-	3

Mathematical Domain	Cluster	Standard	Sequence and Duration
	the same between any two distinct points	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*.	
	Analyze and solve linear equations and pairs of simultaneous linear equations	8.EE.7. Solve linear equations in one variable. a. Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form *x* = *a*, *a* = *a*, or *a* = *b* results (where *a* and *b* are different numbers). b. Solve linear equations with rational coefficients, including equations whose solutions require expanding expressions using the distributive property and combining like terms.	2
		8.EE.8. Analyze and solve systems of linear equations. a. Show that the solution to a system of two linear equations in two variables is the intersection of the graphs of those equations because points of intersection satisfy both equations simultaneously. b. Solve systems of two linear equations in two variables and estimate solutions by graphing the equations. Simple cases may be done by inspection. *For example, 3x + 2y = 5 and 3x + 2y = 6 have no solution because 3x + 2y cannot simultaneously be 5 and 6.* c. Solve real-world and mathematical problems leading to two linear equations in two variables. *For example, given coordinates for two pairs of points, determine whether the line through the first pair of points intersects the line through the second pair.*	2
<u>Functions (F)</u>	Define, evaluate, and compare functions.	8.F.1. Understand that a function is a rule that assigns to each input (the domain) exactly one output (the range). The graph of a function is the set of ordered pairs consisting of an input and the corresponding output. For example, use the vertical line test to determine functions and non-functions.	2
		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.*	2
		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 = s2 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.*	2
	Use functions to model	8.F.4. Construct a function to model a linear relationship	2

Mathematical Domain	Cluster	Standard	Sequence and Duration
	relationships between quantities.	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	
		8.F.5. Given a verbal description between two quantities, sketch a graph. Conversely, given a graph, describe a possible real-world example. *For example, graph the position of an accelerating car or tossing a ball in the air.*	2
Geometry (G)	Understand congruence and similarity using physical models, transparencies, or geometry software.	8.G.1. Through experimentation, verify the properties of rotations, reflections, and translations (transformations) to figures on a coordinate plane). a. Lines are taken to lines, and line segments to line segments of the same length. b. Angles are taken to angles of the same measure. c. Parallel lines are taken to parallel lines	3
		8.G.2. Demonstrate understanding of congruence by applying a sequence of translations, reflections, and rotations on two dimensional figures. Given two congruent figures, describe a sequence that exhibits the congruence between them.	3
		8.G.3. Describe the effect of dilations, translations, rotations, and reflections on two dimensional figures using coordinates	3
		8.G.4. Demonstrate understanding of similarity, by applying a sequence of translations, reflections, rotations, and dilations on two-dimensional figures. Describe a sequence that exhibits the similarity between them.	3
		8.G.5. Justify using informal arguments to establish facts about *the angle sum of triangles (sum of the interior angles of a triangle is 180º), *measures of exterior angles of triangles, *angles created when parallel lines are cut be a transversal (e.g., alternate interior angles), and *angle-angle criterion for similarity of triangles.	3
	Understand and apply the Pythagorean Theorem.	8.G.6. Explain the Pythagorean Theorem and its converse.	3
		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.	3
		8.G.8. Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.	3
	Solve real-world and mathematical problems	8.G.9. Identify and apply the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-	4

Mathematical Domain	Cluster	Standard	Sequence and Duration
	involving volume of cylinders, cones, and spheres.	world and mathematical problems.	
		8.SP.2. Explain why 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.	4
		8.SP.3. Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and *y*-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*	4
		8.SP.4. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects and use relative frequencies 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?*	4

HIGH SCHOOL MATH
(9-12)

Curriculum Sequence: Algebra Class

Conceptual Categories	Domain	Standard	Sequence and Duration
<u>Number and Quantity (N)</u>	The Real Number System	N-RN.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.*	1
		N-RN.2. Rewrite expressions involving radicals and rational exponents using the properties of exponents. *For example: Write equivalent representations that utilize both positive and negative exponents*	1
		N-RN.3. Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational.	1
	Quantities*	N-Q.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.	1, 2, 3
		N-Q.2. Define appropriate quantities for the purpose of descriptive modeling.	1, 2, 3
		N-Q.3. Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.	1, 2, 3
	The Complex Number System	N-CN.1. Know there is a complex number *i* such that *i*2 = –1, and every complex number has the form *a* + *bi* with *a* and *b* real.	1, 2
		N-CN.2. Use the relation *i*2 = –1 and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.	1, 2
		N-CN.7. Solve quadratic equations with real coefficients that have complex solutions.	1, 2
<u>Algebra (A)</u>	Seeing Structure in Expressions	A-SSE.1. Interpret expressions that represent a quantity in terms of its context.* a. Interpret parts of an expression, such as terms, factors, and coefficients. b. Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example, interpret P*(1+*r*)n *as the product of P and a factor not depending on P.*	1
		A-SSE.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 +	1

Conceptual Categories	Domain	Standard	Sequence and Duration
		*y*2).	
		A-SSE.3. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.* a. Factor a quadratic expression to reveal the zeros of the function it defines. *For example, x2 + 4x +3 = (x +3)(x +1)*. b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines. *For example, x2 + 4x + 3 = (x + 2)2 - 1*. c. Use the properties of exponents to transform expressions for exponential functions. *For example the expression 1.15t can be rewritten as* (1.151/12)12*t* ≈ 1.01212*t to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.*	1
	Arithmetic with Polynomials and Rational Expressions	A-APR.1. Add, subtract, and multiply polynomials. Understand that polynomials form a system similar to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication.	1
		A-APR.2. 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*).	2
		A-APR.3. Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.	2
		A-APR.4. Prove polynomial identities and use them to describe numerical relationships. *For example, the polynomial identity* (*x*2 + *y*2)2 = (*x*2 – *y*2)2 + (2*xy*)2 *can be used to generate Pythagorean triples.*	2
		A-APR.6. Rewrite simple rational expressions in different forms; write *a*(*x*)/*b*(*x*) in the form *q*(*x*) + *r*(*x*)/*b*(*x*), where *a*(*x*), *b*(*x*), *q*(*x*), and *r*(*x*) are polynomials with the degree of *r*(*x*) less than the degree of *b*(*x*), using inspection, long division, or, for the more complicated examples, a computer algebra system.	3
	Creating Equations and Inequalities	A-CED.1. Create equations and inequalities in one variable and use them to solve problems. *Include equations arising from linear and quadratic functions, and simple rational and exponential functions.*	1, 3, 4
		A-CED.2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.	1, 2

Conceptual Categories	Domain	Standard	Sequence and Duration
		A-CED.3. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. *For example, represent inequalities describing cost constraints in various situations.*	1, 2
		A-CED.4. Rearrange formulas (literal equations) 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.*	1, 2
	Reasoning with Equations and Inequalities	A-REI.1. Apply properties of mathematics to justify steps in solving equations in one variable.	1, 2, 3
		A-REI.2. Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.	3
		A-REI.3. Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.	1
		A-REI.4. Solve quadratic equations in one variable. a. Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x – p)2 = q$ that has the same solutions. Derive the quadratic formula from this form. b. Solve quadratic equations by inspection (e.g., for $x2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers a and b.	2
		A-REI.5. Show 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	1
		A-REI.6. Solve systems of linear equations exactly and approximately, e.g., with graphs or algebraically, focusing on pairs of linear equations in two variables	1
		A-REI.7. Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. *For example, find the points of intersection between the line $y = –3x$ and the circle $x2 + y2 = 3$.*	2
		A-REI.10. Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).	1, 2
		A-REI.11. Explain why the x-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$	1, 2

Conceptual Categories	Domain	Standard	Sequence and Duration
		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.*	
		A-REI.12. Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.	1
Functions (F)	Interpreting Functions	F-IF.1. 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 equation $y = f(x)$.	1, 2, 3
		F-IF.2. Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.	1, 2, 3
	.	F-IF.4. For a function that models a relationship between two quantities, * interpret key features of graphs and tables in terms of the quantities, and *sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.**	1, 2, 3
		F-IF.5. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then negative numbers would be an appropriate domain for the function.**	1, 2, 3
		F-IF.6. Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.*	1
		F-IF.7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.* a. Graph linear and quadratic functions and show intercepts, maxima, and minima. b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. c. Graph polynomial functions, identifying zeros (using	1, 2, 3

Conceptual Categories	Domain	Standard	Sequence and Duration
		technology) or algebraic methods when suitable factorizations are available, and showing end behavior. d. (+) Graph rational functions, identifying zeros and discontinuities (asymptotes/holes) using technology, and algebraic methods when suitable factorizations are available, and showing end behavior. e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.	
		F-IF.8. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context. b. Use the properties of exponents to interpret expressions for exponential functions. *For example, identify percent rate of change in functions such as y = (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.*	2, 3
		F-IF.9. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically, in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.*	1, 2, 3
	Building Functions	F-BF.1. 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.*	1
		F-BF.3. 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.*	1, 2, 3
		F-BF.4. Find inverse functions. 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) = 2x3 for x > 0 or f(x) = (x + 1)/(x – 1) for x ≠ 1.*	1

Conceptual Categories	Domain	Standard	Sequence and Duration
	Linear, Quadratic, and Exponential Models*	F-LE.1. Distinguish between situations that can be modeled with linear functions and with exponential functions. a. Show that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals. b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.	3
		F-LE.2. Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or input-output table of values.	1, 3
		F-LE.3. Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.	3
		F-LE.4. For exponential models, express as a logarithm the solution to *ab*ct = *d* where *a*, *c*, and *d* are numbers and the base *b* is 2, 10, or *e*; evaluate the logarithm using technology.	1, 3
		F-LE.5. Interpret the parameters in a linear or exponential function in terms of a context.	1, 3
	Interpreting Functions	F-IF.1. 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 equation y = f(x).	1, 2 (Algebra)
Geometry (G)	Expressing Geometric Properties with Equations	G-GPE.2. Determine or derive the equation of a parabola given a focus and directrix.	2
Statistics and Probability (S)	Interpreting Categorical and Quantitative Data	S-ID.1. Represent data with plots on the real number line (dot plots, histograms, and box plots).	4
		S-ID.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.	4
		S-ID.3. Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers). *For example: Justify why median price of homes or income is used instead of the mean.*	4
		S-ID.4. Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators,	4

Conceptual Categories	Domain	Standard	Sequence and Duration
		spreadsheets, and tables to estimate areas under the normal curve.	
	.	S-ID.5. 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	4
		S-ID.6. 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, quadratic, and exponential models.* b. Informally assess the fit of a function by plotting and analyzing residuals. *For example: Describe solutions to problems that require interpolation and extrapolation.* c. Fit a linear function for a scatter plot that suggests a linear association.	4
	.	S-ID.7. Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.	4
		S-ID.8. Compute (using technology) and interpret the correlation coefficient of a linear fit.	4
		S-ID.9. Distinguish between correlation and causation.	4
	Making Inferences and Justifying Conclusions	S-IC.1. Understand statistics as a process for making inferences about population parameters based on a random sample from that population.	4
		S-IC.2. 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 the model?*	4
		S-IC.3. Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.	4
		S-IC.4. Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.	4
		S-IC.5. Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.	4
		S-IC.6. Evaluate reports based on data.	4
	Conditional Probability and the Rules of Probability	S-CP.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”).	4

Conceptual Categories	Domain	Standard	Sequence and Duration
		S-CP.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.	4
		S-CP.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*.	4
		S-CP.4. Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. *For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in 10th grade. Do the same for other subjects and compare the results.*	4
		S-CP.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.*	4
		S-CP.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.	4
		S-CP.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.	4

Curriculum Sequence: Geometry Class

Conceptual Category	Domain	Standard	Sequence and Duration
Algebra (A)	Seeing structures in Expressions	A-SSE 4. Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. *For example, calculate mortgage payments.**	Q1 – sequence & series
Functions (F)	Interpreting Functions	F-IF 3. Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers	Q1 – sequence & series
	Building Functions	F-BF 1. Write a function that describes a relationship between two quantities. Determine an explicit expression, a recursive process, or steps for calculation from a context. Combine standard function types using arithmetic operations.	Q1 – sequence & series
		F-BF 2. Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms	Q1 – sequence & series
	Linear, Quadratic, and Exponential Models	F-LE 2. Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a descriptions of a relationship, or input-output table of values	Q1 – sequence & series
Geometry (G)	Congruence	G-CO 1. Demonstrates understanding of key geometrical definitions, including angle, circle, perpendicular line, parallel line, line segment, and transformations in Euclidian geometry. Understand undefined notions of point, line, distance along a line, and distance around a circular arc.	Q1- Definitions & concepts
		G-CO 9. Using methods of proof including direct, indirect, and counter examples to 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.*	Q1- Definitions & concepts
		G-CO 12. 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.*	Q1- Definitions & concepts
	Expressing Geometric	G-GPE 5. Prove the slope criteria for parallel and	Q1- Definitions

Conceptual Category	Domain	Standard	Sequence and Duration
	Properties with Equations	perpendicular lines and 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)	& concepts
		G-GPE 6. Find the point on a directed line segment between two given points that partitions the segment in a given ratio.	Q1- Definitions & concepts
	Congruence	G-CO 7. Use the definitions of congruence in terms of rigid motions to show that two triangles are congruent if corresponding pairs of sides and corresponding pairs of angles are congruent.	Q2- triangles
		G-CO 8. Explain how the criteria for triangle congruence (ASA, SAS, SSS, AAS, and HL) Follow from the definition of congruence in terms of rigid motions	Q2- triangles
		G-CO 10. Using methods of proof including direct, indirect and counter examples to prove theorems about triangles. Theorems include: measure 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.	Q2- triangles
		G-CO 13. Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle	Q2- triangles
	Similarity, Right Triangles, and Trigonometry	G-SRT 2. Given two figures, use the definition of similarity in terms of transformations to explain whether or not they are similar	Q2- triangles
		G-SRT 3. Use the properties of similarity transformations to establish the AA criterion of two triangles to be similar	Q2- triangles
		G-SRT 4. Prove theorems about triangles. Theorems include: a line parallel to one side of a triangle divides the other two proportionally, and conversely.	Q2- triangles
		G-SRT 5. Apply congruence and similarity properties and prove relationships involving triangles and other geometric figures	Q2- triangles
		G-SRT 6. Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute triangles.	Q2- triangles
		G-SRT 8. Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems *	Q2- triangles
	Expressing Geometric Properties with Equations	G-GPE 4. Perform simple coordinate proofs	Q2- triangles
		G-GPE 7. Use coordinates to computer perimeters	Q2- triangles

Conceptual Category	Domain	Standard	Sequence and Duration
		of polygons and areas of triangles and rectangles	
	Modeling with Geometry	G-MG 1. Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).*	Q2- triangles
		G-MG 2. Apply concepts of density based on area and volume in modeling situations. (e.g., persons per square miles, BTUs per cubic feet) *	Q2- triangles
		G-MG 3. Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize costs; working with typographic grid systems based on rations) *	Q2- triangles
	Create equations and inequalities	A-CED 4. Rearrange formulas (literal equations) 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.*	Q2 – triangles
<u>Functions (F)</u>	Trigonometric Functions	F-TF 1. Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle	Q3 – Trig. Functions
		F-TF 2. Explain how the unit circle in the coordinate plane enables the extension of trigonometric function to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.	Q3 – Trig. Functions
		F-TF 5. Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline. *	Q3 – Trig. functions
		F-TF 8. Prove the Pythagorean identity sin2(θ) + cos2(θ) = 1 and use it to calculate trigonometric ratios.	Q3 – Trig. Functions
<u>Geometry (G)</u>	Similarity, Right Triangles, and Trigonometry	G-SRT.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 segment is longer or shorter in the ratio given by the scale factor.	Q3- transformations
		G-SRT 2. Given two figures, use the definition of similarity in terms of transformations to explain whether or not they are similar.	Q3 – polygons
		G-SRT 7. Explain and use the relationship between the sine and cosine of complementary angles.	Q3 – Trig. Functions
		G-SRT 8. Use trigonometric ratios and the Pythagorean theorem to solve right triangles in	Q3 – Trig. functions

Conceptual Category	Domain	Standard	Sequence and Duration
		applied problems *	
Functions (F)	Interpreting Functions	F-IF 7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.* a. Graph linear and quadratic functions and show intercepts, maxima, and minima. b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. c. Graph polynomial functions, identifying zeros (using technology) or algebraic methods when suitable factorizations are available, and showing end behavior. d. (+) Graph rational functions, identifying zeros and discontinuities (asymptotes/holes) using technology, and algebraic methods when suitable factorizations are available, and showing end behavior. e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.	Q3 – Trig. functions
Geometry (G)	Congruence	G-CO 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).	Q3 – transformations
		G-CO 3. Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.	Q3 – transformations
		G-CO 4. Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.	Q3 – transformations
		G-CO 5. Given a geometric figure and a rotation, reflection, or translation, draw the 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.	Q3 – transformations
		G-CO 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.	Q3 – transformations
		G-CO 11. Using methods of proof including direct,	Q3 – polygons

Conceptual Category	Domain	Standard	Sequence and Duration
		indirect, and counter examples to 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.*	
		G-CO 13. Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.	Q3 – polygons
	Modeling with Geometry	G-MG 1. Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).*	Q3 - polygons
		G-MG 2. Apply concepts of density based on area and volume in modeling situations. (e.g., persons per square miles, BTUs per cubic feet) *	Q3 - polygons
		G-MG 3. Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize costs; working with typographic grid systems based on rations) *	Q3 - polygons
<u>Algebra (A)</u>	Create equations and inequalities	A-CED 4. Rearrange formulas (literal equations) 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.*	Q3 - polygons
<u>Geometry (G)</u>	Expressing Geometric Properties with Equations	G-GPE 4. Perform simple coordinate proofs. *For example, prove or disprove that a figure defined by four given points in the coordinate 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).*	Q3 - polygons
		G-GPE 7. Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.*	Q3- polygons
	Circles	G-C 1. Prove that all circles are similar.	Q4 - circles
		G-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.*	Q4 - circles
		G-C 3. Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.	Q4 - circles
		G-C 5. Use and apply the concepts of arc length and areas of sectors of circles. Determine or derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the	Q4 - circles

Conceptual Category	Domain	Standard	Sequence and Duration
		radius, and define the radian measure of the angle as the constant of proportionality; derive the formula for the area of a sector.	
	Expressing Geometric Properties with Equations	G-GPE 1. Determine or 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.	Q4 - circles
	Congruence	G-CO 13. Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.	Q4 – circles
	Modeling with Geometry	G-MG 1. Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).*	Q4 – circles, polyhedrons
		G-MG 2. Apply concepts of density based on area and volume in modeling situations. (e.g., persons per square miles, BTUs per cubic feet) *	Q4 – circles, polyhedrons
		G-MG 3. Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize costs; working with typographic grid systems based on rations) *	Q4 – circles, polyhedrons
Algebra (A)	Create equations and inequalities	A-CED 4. Rearrange formulas (literal equations) 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.*	Q4 – circles, polyhedrons
Geometry (G)	Geometric Measurement and Dimensions	G-GMD 1. Explain how to find the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone.	Q4 - polyhedrons
		G-GMD 3. Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.*	Q4 – polyhedrons
		G-GMD 4. Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.	Q4 - polyhedrons

Curriculum Sequence: Advanced Algebra

Conceptual Category	Domain	Standard	Sequence and Duration
Number and Quantity (N)	Vector & Matrices Qualities	N-VM 6 – Use matrices to represent and manipulate data	1
		N-VM 7 – Multiply matrices by scalars to produce new matrices	1
		N-VM 8 – Add, subtract, and multiply matrices of appropriate dimensions	1
		N-VM 9 – Understand that, unlike multiplication of numbers, matrix multiplication for square matrices is not a commutative operation, but still satisfies that associative and distributive properties	1
		N-VM 10 – Understand that the zero and identity matrices play a role in matrix addition and multiplication similar to the role of 0 and 1 in real numbers. The determinant of a square matrix is nonzero if and only if the matrix has a multiplication inverse	1
Algebra (A)	Reasoning with Equations and Inequalities	A-REI 9 – Find the inverse of a matrix if it exists	1
Number and Quantity (N)	Quantities*	N-Q 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.	1
		N-Q 2 – Define appropriate quantities for the purpose of descriptive modeling	1
		N-Q 3 – Choose a level of accuracy appropriate to limitations on measurement when reporting quantities	1
	Complex Number System	N-CN 1 – Know there is a complex number I such that i^2 = -1, and every complex number has the form a + bi with a and b real	1
		N-CN 2 – Use the relation i^2 = -1 and the commutative, association, and distributive properties to add, subtract, and multiply complex numbers	1
		N-CN 3 – Find the conjugate of a complex number; use conjugates to find the moduli and quotients of complex numbers	1
		N-CN 7 – Solve quadratic equations with real coefficients that have complex solutions	1
		N-CN 8 – Extend polynomial identities to the complex numbers	1
		N-CN 9 – Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials.	1
Algebra (A)	Seeing Structure in Expressions	A-SSE 3 – Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression	1
		A-SSE 1– Interpret expressions that represent a quantity in terms of its context.	1

Conceptual Category	Domain	Standard	Sequence and Duration
		A-SSE 2 – Use the structure of an expression to identify ways to rewrite it.	1
	Arithmetic with Polynomials and Rational Expressions	A-APR 1 – Add, subtract, and multiply polynomials. Understand that polynomials form a system similar to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication	1
		A-APR 2 – Know and apply the Remainder Theorem	1
		A-APR 3 – Identity zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.	1
		A-APR 4 – Prove polynomial identities and use them to describe numerical relations	1
		A-APR 5- Know and apply the Binomial Theorem for the expansion of (x + y) ^n	1
	Creating Equations and Inequalities*	A-CED 1 – Create equations and inequalities in one variable and use them to solve problems. (linear and quadratic functions, and simple rational and exponential functions)	1, 2, 3
		A-CED 2 – Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.	1, 2, 3
		A-CED 3 – Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in modeling context	1, 2, 3
	Reasoning with Equations and Inequalities	A-REI 1 – Apply properties of mathematics to justify steps in solving equations in one variable	1, 2, 3
Functions (F)	Interpreting Functions	F-IF 1 – Understand that a function from one set (domain) to another set (range) assigns to each element of the domain exactly one element of the range. If f 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 equation y = f(x).	1, 2, 3
		F-IF 2 – Use function notation, evaluate functions for inputs in their domains and interpret statements that use function notation in terms of a context.	1, 2, 3
		F-IF 4 – For a function that models a relationship between two quantities: interpret key features of graphs and tables in terms of the quantities and sketch graphs showing key features given a verbal description of the relationship (increasing, decreasing, positive, negative, relative maximums and minimums, symmetries and end behavior)	1, 2, 3
		F-IF 5 – Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.	1, 2, 3
		F-IF 7 – Graph functions expressed symbolically and show key features of the graph, by and in simple cases and using technology for more complicated cases. Graph linear and quadratic functions and show intercepts, maxima and	1, 2, 3

Conceptual Category	Domain	Standard	Sequence and Duration
		minima. Graph square root, cube root and piecewise-defined functions, including step functions and absolute value functions. Graph polynomial functions, identifying zeros (using technology) or algebraic methods when suitable factorizations are available and showing end behavior. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude	
	Building Functions	F-BF 3 – Identify the effect on the graph of replacing f(x) by f(x) + k, kf(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	1, 2, 3
Number and Quantities (N)	Radical Expressions and Functions	N-RN 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	2,
		N-RN 3- Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational	2,
		N-RN 2- Rewrite expressions involving radicals and rational exponents using the properties of exponents	2,
<u>Algebra (A)</u>	Reasoning with Equations and Inequalities	A-REI 2 – Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.	2
	Arithmetic with Polynomials and Rational Expressions	A-APR 6 – Rewrite simple rational expressions in different forms by using inspection, long division, or, for the more complicated examples, a computer algebra system.A-APR 7 – Add, subtract, multiply, and divide rational expressions. Understand that rational expressions form a system similar to the rational numbers, closed under addition, subtraction, and multiplication, and division by a nonzero rational expression	2
<u>Functions (F)</u>	Building Functions	F-BF 1 – Write a function that describes a relationship between two quantities. Determine an explicit expression, a recursive process, or steps for calculation from a context. Combine standard function types using arithmetic operations. Compose functions.	3
		F-BF 4 – 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. Verify by composition that one function is the inverse of another. Read values of an inverse function from a graph or a table, given that the function has an inverse. Produce an invertible function from a non-invertible function by restricting the domain.	3

Conceptual Category	Domain	Standard	Sequence and Duration
		F-BF 5- Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents	3
Statistics and Probability (S)	Conditional Probability and the Rules of Probability	S-CP 1 – Describe events as subsets of a sample space using characteristics of the outcomes, or as unions, intersections or complements of other events (or, and, not)	4
		S-CP 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.	4
		S-CP 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	4
		S-CP 4 – Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities.	4
		S-CP 5 – Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations.	
		S-CP 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	4
		S-CP 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	4
		S-CP 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.	4
		S-CP 9 - Use the permutations and combination to compute probabilities of compound events and solve problems	4
	Interpreting Categorical and Quantitative Data	S-ID 1 – Represent data with plots on the real number line (dot plots, histograms and box plots)	4
		S-ID 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	4
		S-ID 3 – Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers)	4
		S-ID 4 – Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which	4

Conceptual Category	Domain	Standard	Sequence and Duration
		such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.	
		S-ID 5 – 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.	4
		S-ID 6 – Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given a function or choose a function suggested by the context. Emphasize linear, quadratic and exponential models. Informally assess the fit of a function by plotting and analyzing residuals. Fit a linear function for a scatter plot that suggests a linear association.	4
		S-ID 7 – Interpret the slope and the intercept of a linear model in the context of the data.	4
		S-ID 8 – Compute (using technology) and interpret the correlation coefficient of a linear fit.	4
		S-ID 9 – Distinguish between correlation and causation Least square measurement Two variable statistics	4
	Using Probability to Make Decisions	S-MD 1- Define a random variable for a quantity of interest by assigning a numerical value to each event in a sample space; graph the corresponding probability distribution using the same graphical displays as for data distributions.	4
		S-MD 2- Calculate the expected value of a random variable; interpret it as the probability distribution	4
		S-MD 3- Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated; find the expected value.	4
		S-MD 4- Develop a probability distribution for a random variable defined for a sample space in which probabilities are assigned empirically; find the expected value.	4
Geometry (G)	Expressing Geometric Properties with Equations	G-GPE 1- determine or 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.	4
		G-GPE 2-Determine or derive the equation of a parabola given a focus and directrix	4
		G-GPE 3- Derive the equations of ellipses and hyperbolas given foci and directrices.	4

Curriculum Sequence: Pre-Calculus

Conceptual Category	Domain	Standard	Sequence and Duration
Number and Quantity (N)	Vector and Matrix Quantities	N-VM.1. (+) Recognize vector quantities as having both magnitude and direction. Represent vector quantities by directed line segments, and use appropriate symbols for vectors and their magnitudes (e.g., ***v***, |***v***|, ||***v***||, ***v***).	3
		N-VM.2. (+) Find the components of a vector by subtracting the coordinates of an initial point from the coordinates of a terminal point.	3
		N-VM.3. (+) Solve problems involving velocity and other quantities that can be represented by vectors.	3
		N-VM.4. (+) Add and subtract vectors. a. Add vectors end-to-end, component-wise, and by the parallelogram rule. Understand that the magnitude of a sum of two vectors is typically not the sum of the magnitudes. b. Given two vectors in magnitude and direction form, determine the magnitude and direction of their sum. c. Understand vector subtraction ***v*** – ***w*** as ***v*** + (–***w***), where –***w*** is the additive inverse of ***w***, with the same magnitude as ***w*** and pointing in the opposite direction. Represent vector subtraction graphically by connecting the tips in the appropriate order, and perform vector subtraction component-wise.	3
		N-VM.5. (+) Multiply a vector by a scalar. a. Represent scalar multiplication graphically by scaling vectors and possibly reversing their direction; perform scalar multiplication component-wise, e.g., as *c*(*v*x, *v*y) = (*cv*x, *cv*y). b. Compute the magnitude of a scalar multiple *c**v*** using ||*c**v***|| = |*c*|***v***. Compute the direction of *c**v*** knowing that when |*c*|***v*** ≠ 0, the direc�on of *c**v*** is either along ***v*** (for *c* > 0) or against ***v*** (for *c* < 0).	3
	The Complex Number System	N-CN.4. (+) Represent complex numbers on the complex plane in rectangular and polar form (including real and imaginary numbers), and explain why the rectangular and polar forms of a given complex number represent the same number.	3
Algebra (A)	Reasoning with Equations and Inequalities	A-REI.1. Apply properties of mathematics to justify steps in solving equations in one variable.	1
Functions (F)	Interpreting Functions	F-IF.7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.* a. Graph linear and quadratic functions and show intercepts, maxima, and minima.	1

Conceptual Category	Domain	Standard	Sequence and Duration
		b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. c. Graph polynomial functions, identifying zeros (using technology) or algebraic methods when suitable factorizations are available, and showing end behavior. d. (+) Graph rational functions, identifying zeros and discontinuities (asymptotes/holes) using technology, and algebraic methods when suitable factorizations are available, and showing end behavior. e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.	
	Trigonometric Functions	F-TF.1. Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.	2
		F-TF.2. 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.	2
		F-TF.3. (+) Use special triangles to determine geometrically the values of sine, cosine, tangent for $\pi/3$, $\pi/4$ and $\pi/6$, and use the unit circle to express the values of sine, cosines, and tangent for $\pi-x$, $\pi+x$, and $2\pi-x$ in terms of their values for x, where x is any real number.	2
		F-TF.4. (+) Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions.	2
		F-TF.5. Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.*	2
		F-TF.6. (+) Understand that restricting a trigonometric function to a domain on which it is always increasing or always decreasing allows its inverse to be constructed.	2
		F-TF.7. (+) Use inverse functions to solve trigonometric equations that arise in modeling contexts; evaluate the solutions using technology, and interpret them in terms of the context.*	2
		F-TF.8. Prove the Pythagorean identity sin2(θ) + cos2(θ) = 1 and use it to calculate trigonometric ratios.	2
		F-TF.9. (+) Prove the addition and subtraction formulas for sine, cosine, and tangent and use them to solve problems.	2
Geometry (G)	Similarity, Right Triangles, and Trigonometry	G-SRT.6. Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.	3
		G-SRT.7. Explain and use the relationship between the sine and cosine of complementary angles.	3
		G-SRT.8. Use trigonometric ratios and the Pythagorean	3

Conceptual Category	Domain	Standard	Sequence and Duration
		Theorem to solve right triangles in applied problems.*	
		G-SRT.9. (+) 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.	3
		G-SRT.10. (+) Prove the Laws of Sines and Cosines and use them to solve problems	3
		G-SRT.11. (+) 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, resultant forces).	3
Standard			
*Based on College Board Standards			4
Limits *			4
Derivatives *			4
Integral *			4

Curriculum Sequence: Statistics

Conceptual Category	Domain	Standard	Sequence and Duration
<u>Statistics and Probability (S)</u>	Interpreting Categorical and Quantitative Data	S-ID.1 Represent data with plots on the real number line (dot plots, histograms, and box plots).	1
		S-ID.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.	1
		S-ID.3 Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers). *For example: Justify why median price of homes or income is used instead of the mean.*	1
		S-ID.4 Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.	1, 2
		S-ID.5 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.	2, 3
		S-ID.6 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, quadratic, and exponential models.* b. Informally assess the fit of a function by plotting and analyzing residuals. *For example: Describe solutions to problems that require interpolation and extrapolation.* c. Fit a linear function for a scatter plot that suggests a liner association.	2, 3
	.	S-ID.7 Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.	2
		S-ID.8 Compute (using technology) and interpret the correlation coefficient of a linear fit.	2
		S-ID.9 Distinguish between correlation and causation.	2, 3
	Making Inferences and Justifying Conclusions	S-IC.1 Understand statistics as a process for making inferences about population parameters based on a random sample from that population.	3, 4
		S-IC.2 Decide if a specified model is consistent with results	3, 4

Conceptual Category	Domain	Standard	Sequence and Duration
		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 the model?*	
		S-IC.3 Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.	3, 4
		S-IC.4 Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.	3, 4
		S-IC.5 Use data randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.	3, 4
		S-IC.6 Evaluate reports based on data.	3, 4
	Conditional Probability and the Rules of Probability	S-CP-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").	3, 4
		S-CP-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.	3, 4
		S-CP-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*.	3, 4
		S-CP-4 Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. *For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in the 10th grade. Do the same for other subjects and compare the results.*	3, 4
		S-CP-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.*	3, 4
		S-CP-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.	3, 4
		S-CP-7 Apply the Addition Rule, P(A or B)= P(A) + P(B) –	3, 4

Conceptual Category	Domain	Standard	Sequence and Duration
		P(A and B), and interpret the answer in terms of the model.	
		S-CP-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.	3, 4
		S-CP-9 (+) Use permutations and combinations to compute probabilities of compound events and solve problems.	3, 4
	Using Probability to Make Decisions	S-MD.1 (+) Define a random variable for a quantity of interest by assigning a numerical value to each event in a sample space; graph the corresponding probability distribution using the same graphical displays as for data distributions.	4
		S-MD.2 (+) Calculate the expected value of a random variable; interpret it as the mean of the probability distribution.	4
		S-MD.3 (+) Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated; find the expected value. *For example, find the theoretical probability distribution for the number of correct answers obtained by guessing on all five questions of a multiple-choice text where each question has four choices, and find the expected grade under various grading schemes*.	4
		S-MD.4 (+) Develop a probability distribution for a random variable defined for a sample space in which probabilities are assigned empirically; find the expected value. *For example, find a current data distribution on the number of TV sets per household in the United States, and calculate the expected number of sets per household. How many TV sets would you expect to find in 100 randomly selected households?*	4
		S-MD.5 (+) Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values. a. Find the expected payoff for a game of chance. *For example, find the expected winnings from a state lottery ticket or a game at a fast-food restaurant*. b. Evaluate and compare strategies on the basis of expected values. *For example, compare a high-deductible versus a low-deductible automobile insurance policy using various, but reasonable, chances of having a minor or a major accident.*	4
		S-MD.6 (+) Use probabilities to make fair decisions (e.g., drawing by lots, using random number generator).	4
		S-MD.7 (+) Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).	4