Bi-County Collaborative

Making It Possible

Mathematics
Curriculum Map
Grades Kindergarten – 12
August 2014

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Making It Possible

Kindergarten Mathematics Curriculum Map

Timeline/Teacher notes on progress	Topic	Standards	Content/Skills	Standards for Mathematical Practice
September – October	Counting and Cardinality	**K.CC** **Know number names and the count sequence.** • 1. Count to 100 by ones and by tens. • 2. Count forward beginning from a given number within the known sequence (instead of having to begin at 1). • 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). **Count to tell the number of objects.** • 4. Understand the relationship between numbers and quantities; connect counting to cardinality. a. When counting objects, say the number names in the standard order, pairing each object with one and only one number name and each number name with one and only one object. b. Understand that the last number name said tells the number of objects counted. The number of objects is the same regardless of their arrangement or the order in which they were counted. c. Understand that each successive number name refers to a quantity that is one larger. • 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.	• Counts by 10 to 100 • Writing numbers • Using Number line • Counting in sequence	MP.6. Attend to precision
	Operations and Algebraic Thinking	**K.OA** **Understand addition as putting together and adding**		

		to, and understand subtraction as taking apart and taking from. • 1. Represent addition and subtraction with objects, fingers, mental images, drawings, sounds (e.g., claps), acting out situations, verbal explanations, expressions, or equations.	• Introduction to addition and subtraction symbols	
November – December	Counting and Cardinality Operations and Algebraic Thinking	**K.CC** **Compare numbers.** • 6. Identify whether the number of objects in one group is greater than, less than, or equal to the number of objects in another group, e.g., by using matching and counting strategies. • 7. Compare two numbers between 1 and 10 presented as written numerals. **K.OA** **Understand addition as putting together and adding to, and understand subtraction as taking apart and taking from.** • 4. For any number from 1 to 9, find the number that makes 10 when added to the given number, e.g., by using objects or drawings, and record the answer with a drawing or equation. • 5. Fluently add and subtract within 5.	• Comparing numbers • Strategies for counting up • Addition and subtraction fluency (within 5)	MP.7. Look for and make use of structure.
January	Measurement and Data	**K.MD** **Describe and compare measurable attributes.** • 1. Describe measurable attributes of objects, such as length or weight. Describe several measurable attributes of a single object. • 2. Directly compare two objects with a measurable attribute in common, to see which object has "more of"/"less of" the attribute, and describe the difference. For example, directly compare the heights of two children and describe one child as taller/shorter. **Classify objects and count the number of objects in each category.**	• Introduction to mass/weight • Comparing two objects with similar attributes	MP.1. Make sense of problems and persevere in solving them.

	Operations and Algebraic Thinking	• 3. Classify objects into given categories; count the numbers of objects in each category and sort the categories by count. **K.OA** **Understand addition as putting together and adding to, and understand subtraction as taking apart and taking from.** • 2. Solve addition and subtraction word problems, and add and subtract within 10, e.g., by using objects or drawings to represent the problem.	• Classifies, sorts, and counts objects in different ways • Introduction to word problems	
February – March	Geometry Operations and Algebraic Thinking	**K.G** **Identify and describe shapes (squares, circles, triangles, rectangles, hexagons, cubes, cones, cylinders, and spheres).** • 1. Describe objects in the environment using names of shapes, and describe the relative positions of these objects using terms such as above, below, beside, in front of, behind, and next to. • 2. Correctly name shapes regardless of their orientations or overall size. • 3. Identify shapes as two-dimensional (lying in a plane, "flat") or three-dimensional ("solid"). **K.OA** **Understand addition as putting together and adding to, and understand subtraction as taking apart and taking from.** • 3. Decompose numbers less than or equal to 10 into pairs in more than one way, e.g., by using objects or drawings, and record each decomposition by a drawing or equation (e.g., 5 = 2 + 3 and 5 = 4 + 1).	• 2-D and 3-D shapes and their attributes • Draw and label shapes. • Word problems	MP.2. Reason abstractly and quantitatively.
April		**K.G** **Analyze, compare, create, and compose shapes.**		MP.5. Use appropriate tools strategically.

		• 4. Analyze and compare two- and three-dimensional shapes, in different sizes and orientations, using informal language to describe their similarities, differences, parts (e.g., number of sides and vertices/"corners") and other attributes (e.g., having sides of equal length). • 5. Model shapes in the world by building shapes from components (e.g., sticks and clay balls) and drawing shapes. • 6. Compose simple shapes to form larger shapes. For example, "Can you join these two triangles with full sides touching to make a rectangle?"	• 2-D sand 3-D shapes and their attributes • Draw and Describe 2-D/3-D shapes	
May – June	Number and Operations in Base Ten	**K.NBT** **Work with numbers 11–19 to gain foundations for place value.** • 1. Compose and decompose numbers from 11 to 19 into ten ones and some further ones, e.g., by using objects or drawings, and record each composition or decomposition by a drawing or equation (e.g., 18 = 10 + 8); understand that these numbers are composed of ten ones and one, two, three, four, five, six, seven, eight, or nine ones. **K.OA** **Understand addition as putting together and adding to, and understand subtraction as taking apart and taking from.** • 2. Solve addition and subtraction word problems, and add and subtract within 10, e.g., by using objects or drawings to represent the problem.	• Decomposing two-digit numbers into tens and ones • Word Problems	MP.4. Model with mathematics

Grade 1 Mathematics Curriculum Map

Timeline/Teacher notes on progress	Topic	Standards	Content/Skills	Standards for Mathematical Practice
September – October	Number and Operations in Base Ten	**1.NBT** **Extend the counting sequence.** • 1. Count to 120, starting at any number less than 120. In this range, read and write numerals and represent a number of objects with a written numeral. **Understand place value.** • 2. Understand that the two digits of a two-digit number represent amounts of tens and ones. Understand the following as special cases: a. 10 can be thought of as a bundle of ten ones called a "ten." 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). • 3. Compare two two-digit numbers based on meanings of the tens and ones digits, recording the results of comparisons with the symbols >, =, and <.	• Count to 120, starting at any number. • Read and write numbers to 150. • Represent the amount of objects with a written numeral (to 150). • Compare two numbers using > and <.	MP.1. Make sense of problems and persevere in solving them.
	Measurement and data	**1.MD** **Measure lengths indirectly and by iterating length units.** • 1. Order three objects by length; compare the lengths of two objects indirectly by using a third object. • 2. Express the length of an object as a whole	• Order objects by length. • Using objects express the	

		number of length units, by laying multiple copies of a shorter object (the length unit) end to end; understand that the length measurement of an object is the number of same-size length units that span it with no gaps or overlaps. *Limit to contexts where the object being measured is spanned by a whole number of length units with no gaps or overlaps.*	length of an object as a whole number of length units.	
November	Operations and Algebraic Thinking	**1.OA** **Understand and apply properties of operations and the relationship between addition and subtraction.** • 3. Apply properties of operations as strategies to add and subtract. *Examples: If 8 + 3 = 11 is known, then 3 + 8 = 11 is also known. (Commutative property of addition.) To add 2 + 6 + 4, the second two numbers can be added to make a ten, so 2 + 6 + 4 = 2 + 10 = 12. (Associative property of addition.)* **Add and subtract within 20.** • 5. Relate counting to addition and subtraction (e.g., by counting on 2 to add 2). • 6. Add and subtract within 20, demonstrating fluency for addition and subtraction within 10. Use mental strategies such as counting on; making ten (e.g., 8 + 6 = 8 + 2 + 4 = 10 + 4 = Add and subtract within 20, demonstrating fluency for addition and subtraction within 10. Use mental strategies such as counting on; making ten (e.g., 8 + 6 = 8 + 2 + 4 = 10 + 4 = **Work with addition and subtraction equations.** • 7. Understand the meaning of the equal sign, and determine if equations involving addition and subtraction are true or false. *For example, which of the following equations are true and which are false? 6 = 6, 7 = 8 – 1, 5 + 2 = 2 + 5, 4 + 1 = 5 + 2.*	• Determine if addition and subtraction equations are true or false. • Add and subtract within 20. • Demonstrate fluency for adding and subtracting within 20. • Explain strategies used to add and subtract	MP.8. Look for and express regularity in repeated reasoning.
December – February	Operations and Algebraic Thinking	**1.OA** **Represent and solve problems involving addition and Subtraction.**		

		• 1. Use addition and subtraction within 20 to solve word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions, e.g., by using objects, drawings, and equations with a symbol for the unknown number to represent the problem. • 2. Solve word problems that call for addition of three whole numbers whose sum is less than or equal to 20, e.g., by using objects, drawings, and equations with a symbol for the unknown number to represent the problem. **Understand and apply properties of operations and the relationship between addition and subtraction.** • 4. Understand subtraction as an *unknown*-addend problem. *For example, subtract 10 – 8 by finding the number that makes 10 when added to 8.* **Work with addition and subtraction equations.** • 8. Determine the unknown whole number in an addition or subtraction equation relating three whole numbers. *For example, determine the unknown number that makes the equation true in each of the equations 8 +? = 11, 5 = □ – 3, 6 + 6 = □.* • MA.9. Write and solve number sentences from problem situations that express relationships involving addition and subtraction within 20.	• Solve word problems using addition and subtraction with objects, drawings, and equations. • Solve word problems that call for addition of three whole numbers whose sum is less than or equal to 20. • Determine the unknown number in addition or subtraction equations. • Determine the unknown number in addition or subtraction equations. • Write and solve number sentences from problem situations of addition or subtraction.	
March – April	Number and Operations in Base 10	**1.NBT** **Understand place value.** • 2. Understand that the two digits of a two-digit number represent amounts of tens and ones. Understand the following as special cases: a. 10 can be thought of as a bundle of ten ones— called a "ten." b. The numbers from 11 to 19 are composed of a ten and one, two, three, four, five, six, seven, eight, or nine ones.	• Mentally find 10 more or 10 less than a given number without having to count. • Subtract multiples of 10 in the range 10-90 from multiples of 10 using concrete models or drawings.	MP.2. Reason abstractly and quantitatively.

	Measurement and Data	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). **Use place value understanding and properties of operations to add and subtract.** • 4. Add within 100, including adding a two-digit number and a one-digit number, and adding a two-digit number and a multiple of 10, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used. Understand that in adding two-digit numbers, one adds tens and tens, ones and ones; and sometimes it is necessary to compose a ten. • 5. Given a two-digit number, mentally find 10 more or 10 less than the number, without having to count; explain the reasoning used. • 6. Subtract multiples of 10 in the range 10–90 from multiples of 10 in the range 10–90 (positive or zero differences), using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used. **1.MD** **Work with money.** • MA.5. Identify the values of all U.S. coins and know their comparative values (e.g., a dime is of greater value than a nickel). Find equivalent values (e.g., a nickel is equivalent to 5 pennies). Use appropriate notation (e.g., 69¢). Use the values of coins in the solutions of problems.	• Add within 100, including adding a two-digit number and a one-digit number, and adding a two-digit number and a multiple of ten, using concrete models or drawings. • Find value of different coin amounts.	
May	Geometry	**1.G** **Reason with shapes and their attributes.**		MP.7. Look for and make use of structure.

		• 1. Distinguish between defining attributes (e.g., triangles are closed and three-sided) versus non-defining attributes (e.g., color, orientation, overall size); build and draw shapes that possess defining attributes. • 2. Compose two-dimensional shapes (rectangles, squares, trapezoids, triangles, half-circles, and quarter-circles) or three-dimensional shapes (cubes, right rectangular prisms, right circular cones, and right circular cylinders) to create a composite shape, and compose new shapes from the composite shape. • 3. Partition circles and rectangles into two and four equal shares, describe the shares using the words *halves*, *fourths*, and *quarters*, and use the phrases *half of*, *fourth of*, and *quarter of*. Describe the whole as two of, or four of the shares. Understand for these examples that decomposing into more equal shares creates smaller shares.	• Describe properties and categorize shapes. • Compare similarities and differences of shapes • Build new shapes and decompose shapes into other shapes. • Build and draw shapes to possess different attributes. • Partition circles and rectangles into equal shares.	
	Measurement and Data	**1.MD** **Tell and write time.** • 3. Tell and write time in hours and half-hours using analog and digital clocks.	• Tell time to the nearest hour and half-hour.	
June	Measurement and Data	**1.MD** **Represent and interpret data.** • 4. Organize, represent, and interpret data with up to three categories; ask and answer questions about the total number of data points, how many in each category, and how many more or less are in one category than in another.	• Organize data. • Represent data on a bar graph. • Interpret data found on a bar graph.	MP.6. Attend to precision.
	Operations and Algebraic Thinking	**1.OA** **Represent and solve problems involving addition and subtraction.** • 1. Use addition and subtraction within 20 to solve word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all	• Answer questions about the data by calculating information from the graph	

		positions, e.g., by using objects, drawings, and equations with a symbol for the unknown number to represent the problem. • 2. Solve word problems that call for addition of three whole numbers whose sum is less than or equal to 20, e.g., by using objects, drawings, and equations with a symbol for the unknown number to represent the problem.		

Grade 2 Mathematics Curriculum Map

Timeline/Teacher notes on progress	Topic	Standards	Content/Skills	Standards for Mathematical Practice
September	Number and Operations in Base Ten	**2.NBT** **Understand place value.** • 1. Understand that the three digits of a three-digit number represent amounts of hundreds, tens, and ones; e.g., 706 equals 7 hundreds, 0 tens, and 6 ones. Understand the following as special cases: a. 100 can be thought of as a bundle of ten tens—called a "hundred." b. The numbers 100, 200, 300, 400, 500, 600, 700, 800, 900 refer to one, two, three, four, five, six, seven, eight, or nine hundreds (and 0 tens and 0 ones). • 2. Count within 1000; skip-count by 5s, 10s, and 100s. • 3. Read and write numbers to 1000 using base-ten numerals, number names, and expanded form. • 4. Compare two three-digit numbers based on meanings of the hundreds, tens, and ones digits, using >, =, and < symbols to record the results of	• Place value • Skip counting by 5s, 10s, 100s (within 1000) • Read and write numbers: base ten number names, expanded form • Compare numbers	MP.8. Look for and express regularity and repeated reasoning.

		comparisons.		
October-December	Number and Operations in Base Ten	**2.NBT** **Use place value understanding and properties of operations to add and subtract.** • 5. Fluently add and subtract within 100 using strategies based on place value, properties of operations, and/or the relationship between addition and subtraction. • 6. Add up to four two-digit numbers using strategies based on place value and properties of operations. • 7. Add and subtract within 1000, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method. Understand that in adding or subtracting three-digit numbers, one adds or subtracts hundreds and hundreds, tens and tens, ones and ones; and sometimes it is necessary to compose or decompose tens or hundreds. • 9. Explain why addition and subtraction strategies work, using place value and the properties of operations 8. Mentally add 10 or 100 to a given number 100–900, and mentally subtract 10 or 100 from a given number 100–900.	• Fluently add and subtract within 50 (using known relationships, creating equivalent sums) • Strategies to fluently add and subtract with 100 • Add or subtract 10 or 100 • Represent sums and differences on a number line • Add or subtract within 1000 using drawings or models • Explain addition and subtraction strategies	MP.1. Make sense of problems and persevere in solving them.
	Measurement and Data	**2.MD** **Relate addition and subtraction to length.** • 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.		
	Operations and Algebraic Thinking	**2.OA** **Add and subtract within 20.** • 2. Fluently add and subtract within 20 using mental strategies. By end of Grade 2, know from memory		

		all sums of two one-digit numbers. • MA.2a. By the end of Grade 2, know from memory related subtraction facts of sums of two one-digit numbers.		
January	Measurement and Data	**2.MD** **Measure and estimate lengths in standard units.** • 1. Measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes. • 2. Measure the length of an object twice, using length units of different lengths for the two measurements; describe how the two measurements relate to the size of the unit chosen. • 3. Estimate lengths using units of inches, feet, centimeters, and meters. **Represent and interpret data.** • 9. Generate measurement data by measuring lengths of several objects to the nearest whole unit, or by making repeated measurements of the same object. Show the measurements by making a line plot, where the horizontal scale is marked off in whole-number units. • 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.	• Measure lengths of objects using appropriate tools • Measure using different units • Estimate length • Represent measurements on line plots, picture graphs, and bar graphs	MP.5. Use appropriate tools strategically.
February/March	Operations and Algebraic Thinking	**2.OA** **Represent and solve problems involving addition and subtraction.** • 1. Use addition and subtraction within 100 to solve one- and two-step word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem. (See Table 1.)	• Solve one- and two-step word problems involving addition and subtraction situations using drawings and equations with a symbol for the unknown.	MP.2. Reason abstractly and quantitatively.

	Measurement and Data	**2.MD** **Measure and estimate lengths in standard units.** • 4. Measure to determine how much longer one object is than another, expressing the length difference in terms of a standard length unit. **Relate addition and subtraction to length.** • 5. Use addition and subtraction within 100 to solve word problems involving lengths that are given in the same units, e.g., by using drawings (such as drawings of rulers) and equations with a symbol for the unknown number to represent the problem. **Work with time and money.** • 8. Solve word problems involving dollar bills, quarters, dimes, nickels, and pennies, using $ and ¢ symbols appropriately. *Example: If you have 2 dimes and 3 pennies, how many cents do you have?*	• Measure and compare measurements • Use addition and subtraction to solve word problems involving length • Word problems involving money	
April	Geometry Measurement and Data	**2.G** **Reason with shapes and their attributes.** • 3. Partition circles and rectangles into two, three, or four equal shares, describe the shares using the words *halves*, *thirds*, *half of*, *a third of*, etc., and describe the whole as two halves, three thirds, four fourths. Recognize that equal shares of identical wholes need not have the same shape. **2.MD** **Work with time and money.** • 7. Tell and write time from analog and digital clocks to the nearest five minutes, using a.m. and p.m. • MA.7a. Know the relationships of time, including seconds in a minute, minutes in an hour, hours in a day, days in a week, a month, and a year; and weeks in a month and a year.	• Halves, thirds, and fourths of the whole • Tell and write time to the nearest five minutes • Relationship between units of time (seconds, minutes, hours, days, weeks, months, years)	MP.6. Attend to precision.
May	Geometry	**2. G.** **Reason with shapes and their attributes.** • 1. Recognize and draw shapes having specified attributes, such as a given number of angles or a given number of equal faces. Identify triangles,	• Recognize shapes have certain attributes	MP.7. Look for and make sense of structure.

		quadrilaterals, pentagons, hexagons, and cubes.		
June	Geometry Operations and Algebraic Thinking	**2.G** **Reason with shapes and their attributes.** • 2. Partition a rectangle into rows and columns of same-size squares and count to find the total number of them. **2.OA** **Work with equal groups of objects to gain foundations for multiplication.** • 3. Determine whether a group of objects (up to 20) has an odd or even number of members, e.g., by pairing objects or counting them by 2s; write an equation to express the total as a sum of equal addends. • 4. Use addition to find the total number of objects arranged in rectangular arrays with up to 5 rows and up to 5 columns; write an equation to express the total as a sum of equal addends.	• Partition a rectangle into rows and columns • Odd and even numbers • Using addition to find total number of objects in arrays	MP.4. Model with mathematics.

Grade 3 Mathematics Curriculum Map

Timeline/Teacher notes on progress	Topic	Standards	Content/Skills	Standards for Mathematical Practice
September	Number and Operations in Base Ten Operations and	**3.NBT** **Use place value understanding and properties of operations to perform multi-digit arithmetic.** • 2. Fluently add and subtract within 1000 using strategies and algorithms based on place value, properties of operations, and/or the relationship between addition and subtraction. **3.OA**	• Addition and subtraction fact fluency	MP.8. Look for and express regularity and repeated reasoning.

	Algebraic Thinking	**Represent and solve problems involving multiplication and division.** • 1. Interpret products of whole numbers, e.g., interpret 5 × 7 as the total number of objects in 5 groups of 7 objects each. *For example, describe a context in which a total number of objects can be expressed as 5 × 7.* **Solve problems involving the four operations, and identify and explain patterns in arithmetic.** • 8. Solve two-step word problems using the *four* operations. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding.	• Exploring the concept of multiplication • Solving word problems in addition and subtraction	
	Measurement and Data	**3.MD** **Solve problems involving measurement and estimation of intervals of time, liquid volumes, and masses of objects.** • 1. Tell and write time to the nearest minute and measure time intervals in minutes. Solve word problems involving addition and subtraction of time intervals in minutes, e.g., by representing the problem on a number line diagram.	• Time	
October	Number and Operations in Base Ten	**3.NBT** **Use place value understanding and properties of operations to perform multi-digit arithmetic.** • 1. Use place value understanding to round whole numbers to the nearest 10 or 100 • 2. Fluently add and subtract within 1000 using strategies and algorithms based on place value, properties of operations, and/or the relationship between addition and subtraction.	• Place Value • Rounding • Multi-digit Addition and Subtraction strategies	MP.1. Make sense of problems and persevere in solving them.
	Measurement and Data	**3.MD** **Geometric measurement: recognize perimeter as an attribute of plane figures and distinguish between linear and area measures.**		

	Operations and Algebraic Thinking	• 8. Solve real-world and mathematical problems involving perimeters of polygons, including finding the perimeter given the side lengths, finding an unknown side length, and exhibiting rectangles with the same perimeter and different areas or with the same area and different perimeters. **3.OA** **Solve problems involving the four operations, and identify and explain patterns in arithmetic.** • 8. Solve two-step word problems using the *four* operations. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding.	• Perimeter • Solving word problems in addition and subtraction	
November – December	Operations and Algebraic Thinking	**3.OA** **Represent and solve problems involving multiplication and division.** • 1. Interpret products of whole numbers, e.g., interpret 5 × 7 as the total number of objects in 5 groups of 7 objects each. *For example, describe a context in which a total number of objects can be expressed as 5 × 7.* • 2. Interpret whole-number quotients of whole numbers, e.g., interpret 56 ¸ 8 as the number of objects in each share when 56 objects are partitioned equally into 8 shares, or as a number of shares when 56 objects are partitioned into equal shares of 8 objects each. *For example, describe a context in which a number of shares or a number of groups can be expressed as* 56 ¸ 8*.* • 3. Use multiplication and division within 100 to solve word problems in situations involving equal groups, arrays, and measurement quantities, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem • 4. Determine the unknown whole number in a	• Multiplication and division strategies	MP.2. Reason abstractly and quantitatively.

		multiplication or division equation relating three whole numbers. *For example, determine the unknown number that makes the equation true in each of the equations 8 ´ ? = 48, 5 = □ ¸ 3, 6 ´ 6 =?* **Understand properties of multiplication and the relationship between multiplication and division.** • 5. Apply properties of operations as strategies to multiply and divide. *Examples: If 6 ´ 4 = 24 is known, then 4 ´ 6 = 24 is also known. (Commutative property of multiplication.) 3 ´ 5 ´ 2 can be found by 3 ´ 5 = 15, then 15 ´ 2 = 30, or by 5 ´ 2 = 10, then 3 ´ 10 = 30. (Associative property of multiplication.) Knowing that 8 ´ 5 = 40 and 8 ´ 2 = 16, one can find 8 ´ 7 as 8 ´ (5 + 2) = (8 ´ 5) + (8 ´ 2) = 40 + 16 = 56. (Distributive property.)* • 6. Understand division as an unknown-factor problem. *For example, find 32 ¸ 8 by finding the number that makes 32 when multiplied by 8.* **Multiply and divide within 100.** • 7. Fluently multiply and divide within 100, using strategies such as the relationship between multiplication and division (e.g., knowing that 8 ´ 5 = 40, one knows 40 ¸ 5 = 8) or properties of operations. By the end of Grade 3, know from memory all products of two one-digit numbers. **Solve problems involving the four operations, and identify and explain patterns in arithmetic.** • 8. Solve two-step word problems using the four operations. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding. • 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*	• Fluency with multiplication/division facts • Solving word problems in addition and subtraction	

	Number and Operations in Base Ten	*decomposed into two equal addends.* **3.NBT** **Use place value understanding and properties of operations to perform multi-digit arithmetic.** • 3. Multiply one-digit whole numbers by multiples of 10 in the range 10–90 (e.g., 9 ´ 80, 5 ´ 60) using strategies based on place value and properties of operations.		
January	Measurement and Data Operations and Algebraic Thinking	**3.MD** **Solve problems involving measurement and estimation of intervals of time, liquid volumes, and masses of objects.** • 1. Tell and write time to the nearest minute and measure time intervals in minutes. Solve word problems involving addition and subtraction of time intervals in minutes, e.g., by representing the problem on a number line diagram. • 2. Measure and estimate liquid volumes and masses of objects using standard units of grams (g), kilograms (kg), and liters (*l*). Add, subtract, multiply, or divide to solve one-step word problems involving masses or volumes that are given in the same units, e.g., by using drawings (such as a beaker with a measurement scale) to represent the problem. **Represent and interpret data.** • 3. Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories. Solve one- and two-step "how many more" and "how many less" problems using information presented in scaled bar graphs. *For example, draw a bar graph in which each square in the bar graph might represent 5 pets.* **3.OA** **Solve problems involving the four operations, and identify and explain patterns in arithmetic.**	• Elapsed time • Mass/Capacity problems • Scaled graphs • Word problems in addition, subtraction, and	MP.5. Use appropriate tools strategically.

		• 8. Solve two-step word problems using the four operations. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies, including rounding.	multiplication	
February – March	Operations and Algebraic Thinking	**3.OA** **Represent and solve problems involving multiplication and division.** • 1. Interpret products of whole numbers, e.g., interpret 5 × 7 as the total number of objects in 5 groups of 7 objects each. *For example, describe a context in which a total number of objects can be expressed as 5 × 7.* • 2. Interpret whole-number quotients of whole numbers, e.g., interpret 56 ÷ 8 as the number of objects in each share when 56 objects are partitioned equally into 8 shares, or as a number of shares when 56 objects are partitioned into equal shares of 8 objects each. *For example, describe a context in which a number of shares or a number of groups can be expressed as 56 ÷ 8.* • 3. Use multiplication and division within 100 to solve word problems in situations involving equal groups, arrays, and measurement quantities, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem. • 4. Determine the unknown whole number in a multiplication or division equation relating three whole numbers. *For example, determine the unknown number that makes the equation true in each of the equations 8 × ? = 48, 5 = □ ÷ 3, 6 × 6 =?* **Understand properties of multiplication and the relationship between multiplication and division.** • 5. Apply properties of operations as strategies to multiply and divide. *Examples: If 6 × 4 = 24 is known, then 4 × 6 = 24 is also known.*	• Multiplication and Division • Fluently multiply or divide within 100 • Use number models in word problems • Associative, Commutative, and Distributive Properties	

	Measurement and Data	*(Commutative property of multiplication.) 3 × 5 × 2 can be found by 3 × 5 = 15 then 15 × 2 = 30, or by 5 × 2 = 10 then 3 × 10 = 30. (Associative property of multiplication.) Knowing that 8 × 5 = 40 and 8 × 2 = 16, one can find* *8 × 7 as 8 × (5 + 2) = (8 × 5) + (8 × 2) = 40 + 16 = 56. (Distributive property.)* • 6. Understand division as an unknown-factor problem. *For example, find 32 ÷ 8 by finding the number that makes 32 when multiplied by 8.* **Multiply and divide within 100.** • 7. Fluently multiply and divide within 100, using strategies such as the relationship between multiplication and division (e.g., knowing that 8 × 5 = 40, one knows 40 ÷ 5 = 8) or properties of operations. By the end of grade 3, know from memory all products of two one-digit numbers. **Solve problems involving the four operations, and identify and explain patterns in arithmetic.** • 8. Solve two-step word problems using the four operations. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies, including rounding. • 9. Identify arithmetic patterns (including patterns in the addition table or multiplication table) and explain them using properties of operations. *For example, observe that 4 times a number is always even, and explain why 4 times a number can be decomposed into two equal addends.* **3.MD** **Geometric measurement: understand concepts of area and relate area to multiplication and to addition.** • 5. Recognize area as an attribute of plane figures and understand concepts of area	• Different strategies to multiply and divide fluently • Word problems in all 4 operations • Identify the correct operation from the context of a problem situation • find the area by counting.	

		measurement. a. A square with side length 1 unit, called "a unit square," is said to have "one square unit" of area, and can be used to measure area. b. A plane figure which can be covered without gaps or overlaps by *n* unit squares is said to have an area of *n* square units. • 6. Measure areas by counting unit squares (square cm, square m, square in, square ft, and improvised units). • 7. Relate area to the operations of multiplication and addition. a. Find the area of a rectangle with whole-number side lengths by tiling it, and show that the area is the same as would be found by multiplying the side lengths. b. Multiply side lengths to find areas of rectangles with whole-number side lengths in the context of solving real-world and mathematical problems, and represent whole-number products as rectangular areas in mathematical reasoning. c. Use tiling to show in a concrete case that the area of a rectangle with whole-number side lengths *a* and *b* + *c* is the sum of $a \times b$ and $a \times c$. Use area models to represent the distributive property in mathematical reasoning. d. Recognize area as additive. Find areas of rectilinear figures by decomposing them into non-overlapping rectangles and adding the areas of the non-overlapping parts, applying this technique to solve real-world problems. **Geometric measurement: recognize perimeter as an attribute of plane figures and distinguish between linear and area measures.** • 8. Solve real-world and mathematical	• find the area of a rectangle by multiplying. • Find the area by decomposing a figure into non-overlapping rectangles and adding the areas of the figures.	

		problems involving perimeters of polygons, including finding the perimeter given the side lengths, finding an unknown side length, and exhibiting rectangles with the same perimeter and different areas or with the same area and different perimeters.		
April – May	Number and Operations-Fractions	**3.NF** **Develop understanding of fractions as numbers.** • 1. Understand a fraction $1/b$ as the quantity formed by 1 part when a whole is partitioned into *b* equal parts; understand a fraction a/b as the quantity formed by *a* parts of size $1/b$. • 2. Understand a fraction as a number on the number line; represent fractions on a number line diagram. a. Represent a fraction $1/b$ on a number line diagram by defining the interval from 0 to 1 as the whole and partitioning it into *b* equal parts. Recognize that each part has size $1/b$ and that the endpoint of the part based at 0 locates the number $1/b$ on the number line. b. Represent a fraction a/b on a number line diagram by marking off *a* lengths $1/b$ from 0. Recognize that the resulting interval has size a/b and that its endpoint locates the number a/b on the number line. • 3. Explain equivalence of fractions in special cases, and compare fractions by reasoning about their size. a. Understand two fractions as equivalent (equal) if they are the same size, or the same point on a number line. b. Recognize and generate simple equivalent fractions, e.g., $1/2 = 2/4$, $4/6 = 2/3$. Explain	• Identify the fraction of a whole • Recognize and generate equivalent fractions. • Compare and order fractions using benchmarks fractions; reasoning about the relationships of the numerator and	MP.4. Model with mathematics

	Measurement and Data Geometry Operations and Algebraic Thinking	why the fractions are equivalent, e.g., by using a visual fraction model. c. Express whole numbers as fractions, and recognize fractions that are equivalent to whole numbers. *Examples: Express 3 in the form 3 = $3/1$; recognize that $6/1$ = 6; locate $4/4$ and 1 at the same point of a number line diagram.* d. Compare two fractions with the same numerator or the same denominator by reasoning about their size. Recognize that comparisons are valid only when the two fractions refer to the same whole. Record the results of comparisons with the symbols >, =, or <, and justify the conclusions, e.g., by using a visual fraction model. **3.MD** **Represent and interpret data.** • 4. Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by making a line plot, where the horizontal scale is marked off in appropriate units—whole numbers, halves, or quarters. **3.G** **Reason with shapes and their attributes.** • 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 areas and describe the area of each part as ¼ of the area of the shape.* **3.OA** **Solve problems involving the four operations, and identify and explain patterns in arithmetic.** • 8. Solve two-step word problems using the four operations. Represent these problems using equations with a letter standing for the unknown	denominator. • Create a visual model to justify the equivalence or comparison of two fractions. • Communicate using appropriate mathematical language and notation including numerator, denominator, equivalent fraction, benchmark fraction, >, <, and =. • Continuation of word problems in all 4 operations	

		quantity. Assess the reasonableness of answers using mental computation and estimation strategies, including rounding.		
June	Geometry	**3.G** **Reason with shapes and their attributes.** • 1. Understand that shapes in different categories (e.g., rhombuses, rectangles, and others) may share attributes (e.g., having four sides), and that the shared attributes can define a larger category (e.g., quadrilaterals). Recognize rhombuses, rectangles, and squares as examples of quadrilaterals, and draw examples of quadrilaterals that do not belong to any of these subcategories.	• Recognize shapes have certain attributes • Describe/Classify Shapes	MP.3. Construct viable arguments and critique the reasoning of others.

Grade 4 Mathematics Curriculum Map

Timeline/Teacher notes on progress	Topic	Standards	Content/Skills	Standards for Mathematical Practice
September	Numbers and Operations in Base Ten	**4.NBT** **Generalize place value understanding for multi-digit whole numbers.** • 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.* • 2. Read and write multi-digit whole numbers using base-ten numerals, number names, and expanded form. Compare two multi-digit numbers based on meanings of the digits in each place, using >, =, and < symbols to record the results of comparisons.	• Generalize place value for multi-digit whole numbers	MP.8. Look for and express regularity and repeated reasoning.

	Operations and Algebraic Thinking Measurement and Data	• 3. Use place value understanding to round multi-digit whole numbers to any place. **Use place value understanding and properties of operations to perform multi-digit arithmetic.** • 4. Fluently add and subtract multi-digit whole numbers using the standard algorithm. **4.OA** **Use the four operations with whole numbers to solve problems.** • 3. Solve multi-step word problems posed with whole numbers and having whole-number answers using the (*four operations*) addition and subtraction, (*including problems in which remainders must be interpreted*). Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding. **4.MD** **Solve problems involving measurement and conversion of measurements from a larger unit to a smaller unit.** • 3. Apply the (*area and*) perimeter formulas for rectangles in real-world and mathematical problems.	• Use place value understanding to fluently add and subtract • Solve multi-step word problems using addition and subtraction using letters for unknown quantity • Calculate perimeter	
October	Number and Operations-Fractions	**4.NF** **Extend understanding of fraction equivalence and ordering.** • 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.	• Fraction equivalence	MP. 7. Look for and make use of structure.
November – December	Operations and Algebraic Thinking	**4.OA** **Use the four operations with whole numbers to solve problems.**		MP.2. Reason abstractly and quantitatively.

	Number and	• 1. Interpret a multiplication equation as a comparison, e.g., interpret 35 = 5 ´ 7 as a statement that 35 is 5 times as many as 7 and 7 times as many as 5. Represent verbal statements of multiplicative comparisons as multiplication equations. • 2. Multiply or divide to solve word problems involving multiplicative comparison, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem, distinguishing multiplicative comparison from additive comparison. • 3. Solve multi-step word problems posed with whole numbers and having whole-number answers using the four operations, including problems in which remainders must be interpreted. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding. • 4. Find all factor pairs for a whole number in the range 1–100. Recognize that a whole number is a multiple of each of its factors. Determine whether a given whole number in the range 1–100 is a multiple of a given one-digit number. Determine whether a given whole number in the range 1–100 is prime or composite. • 5. Generate a number or shape pattern that follows a given rule. Identify apparent features of the pattern that were not explicit in the rule itself. *For example, given the rule "Add 3" and the starting number 1, generate terms in the resulting sequence and observe that the terms appear to alternate between odd and even numbers. Explain informally why the numbers will continue to alternate in this way.* **4.NBT** **Use place value understanding and properties of**	• Multiply to solve word problems • Familiarity with factors and multiples	

	Operations in Base Ten Measurement and Data	**operations to perform multi-digit arithmetic.** 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. **4.MD** **Solve problems involving measurement and conversion of measurements from a larger unit to a smaller unit.** • 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.*	• Use place value understanding to fluently multiply • Use area formula for rectangles • Perimeter	
January	Operations and Algebraic Thinking	**4.OA** **Use the four operations with whole numbers to solve problems.** • 2. Multiply or divide to solve word problems involving multiplicative comparison, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem, distinguishing multiplicative comparison from additive comparison. • 3. Solve multi-step 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. **Generate and analyze patterns.** • 5. Generate a number or shape pattern that	• Use place value understanding to fluently divide • Divide to solve word problems	MP.5. Use appropriate tools strategically.

	Numbers and Operations in Base Ten Measurement and Data	follows a given rule. Identify apparent features of the pattern that were not explicit in the rule itself. *For example, given the rule "Add 3" and the starting number 1, generate terms in the resulting sequence and observe that the terms appear to alternate between odd and even numbers. Explain informally why the numbers will continue to alternate in this way.* **4.NBT** **Use place value understanding and properties of operations to perform multi-digit arithmetic.** • 6. Find whole-number quotients and remainders with up to four-digit dividends and one-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models. **4.MD** **Solve problems involving measurement and conversion of measurements from a larger unit to a smaller unit.** • 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.*	• solve division problems with and without remainders • interpret a remainder in the context of a problem • solve equal grouping and/or equal sharing division number stories • Area formula for rectangles	
February – March	Measurement and Data	**4.MD** **Geometric measurement: Understand concepts of angle and measure angles.** • 5. Recognize angles as geometric shapes that are formed wherever two rays share a common endpoint, and understand concepts of angle measurement: a. An angle is measured with reference to a circle with its center at the common endpoint of the rays, by considering the fraction of the	• Draw and identify points • Understand concepts of angle measurement	MP.4. Model with mathematics.

	Geometry	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. • 6. Measure angles in whole-number degrees using a protractor. Sketch angles of specified measure. • 7. Recognize angle measure as additive. When an angle is decomposed into non-overlapping parts, the angle measure of the whole is the sum of the angle measures of the parts. Solve addition and subtraction problems to find unknown angles on a diagram in real-world and mathematical problems, e.g., by using an equation with a symbol for the unknown angle measure. **4.G** **Draw and identify lines and angles, and classify shapes by properties of their lines and angles.** • 1. Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures. • 2. Classify two-dimensional figures based on the presence or absence of parallel or perpendicular lines, or the presence or absence of angles of a specified size. Recognize right triangles as a category, and identify right triangles. • 3. Recognize a line of symmetry for a two-dimensional figure as a line across the figure such that the figure can be folded along the line into matching parts. Identify line-symmetric figures and draw lines of symmetry.	• rays, angles, lines, line segments • Classify 2-D figures • Identify line symmetry	
April	Number and Operations-	**4.NF** **Extend understanding of fraction equivalence and**		MP.1. Make sense of problems and

	Fractions	**ordering.** • Explain why a fraction *a*/*b* is equivalent to a fraction (*n* ´ *a*)/(*n* ´ *b*) by using visual fraction models, with attention to how the number and size of the parts differ even though the two fractions themselves are the same size. Use this principle to recognize and generate equivalent fractions. • 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. **Build fractions from unit fractions by applying and extending previous understandings of operations on whole numbers.** • 3. Understand a fraction *a*/*b* with *a* > 1 as a sum of fractions 1/*b*. a. Understand addition and subtraction of fractions as joining and separating parts referring to the same whole. b. Decompose a fraction into a sum of fractions with the same denominator in more than one way, recording each decomposition by an equation. Justify decompositions, e.g., by using a visual fraction model. • 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	• Represent and interpret data on a line plot • Ordering fractions • Adding & subtracting fractions • Multiplying fraction by a whole number	persevere in solving them.

		1/*b*, and use this understanding to multiply a fraction by a whole number 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.		
May	Number and Operations-Fractions	**4.NF** **Understand decimal notation for fractions, and compare decimal fractions.** • 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.* • 6. Use decimal notation for fractions with denominators 10 or 100 • 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.	• Solving word problems involving fractions and decimals • Decimal notation • Multiply and divide decimals in a money context	MP.3. Construct viable arguments and critique the reasoning of others.
June	Measurement and Data	**4.MD** **Solve problems involving measurement and conversion of measurements from a larger unit to a smaller unit.** • 1. Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit. Record measurement equivalents in a two-column table. *For example, know that 1 ft is 12 times as long as 1 in. Express the length of a 4 ft snake as 48 in. Generate a conversion table for feet and inches listing the number pairs* (*1, 12*), (*2, 24*), (*3, 36*), … • 2. Use the four operations to solve word problems	• Measurement equivalence • Solving word problems involving distance, time,	MP.6. Attend to precision.

		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.	volume, mass, and money	

Grade 5 Mathematics Curriculum Map

Timeline/Teacher notes on progress	Topic	Standards	Content/Skills	Standards for Mathematical Practice
September	Number and Operations in Base Ten	**5.NBT** **Understand the place value system.** • 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. • 2. Explain patterns in the number of zeros of the product when multiplying a number by powers of 10, and explain patterns in the placement of the decimal point when a decimal is multiplied or divided by a power of 10. Use whole-number exponents to denote powers of 10. • 3. Read, write, and compare decimals to thousandths. a. Read and write decimals to thousandths using base-ten numerals, number names, and expanded form, e.g., 347.392 = 3 ´ 100 + 4 ´ 10 + 7 ´ 1 + 3 ´ (1/10) + 9 ´ (1/100) + 2 ´ (1/1000). b. Compare two decimals to thousandths based on meanings of the digits in each place, using >, =, and < symbols to record the results of comparisons. • 4. Use place value understanding	• recognize powers of ten in multi-digit numbers • Explain patterns in the number of zeroes • Compare and round decimals • Place value of decimals	MP.1. Make sense of problems and persevere in solving them.

	Measurement and Data	to round decimals to any place **Perform operations with multi-digit whole numbers and with decimals to hundredths.** • 7. Add, subtract, multiply, and divide decimals to hundredths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used. **5.MD** **Convert like measurement units within a given measurement system.** • 1. Convert among different-sized standard measurement units within a given measurement system (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real-world problems.	• Add and subtract whole numbers and decimals to the hundredths place • Metric conversions	
October	Number and Operations in Base Ten	**5.NBT** **Perform operations with multi-digit whole numbers and with decimals to hundredths.** • 5. Fluently multiply multi-digit whole numbers using the standard algorithm. • 6. Find whole-number quotients of whole numbers with up to four-digit dividends and two-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models. • 7. Add, subtract, multiply, and divide decimals to hundredths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used.	• Develop multiplication and division strategies for whole numbers and decimals	MP.8. Look for and express regularity in repeated reasoning.

November – December	Number and Operations-Fractions Measurement and Data	**5.NF** **Use equivalent fractions as a strategy to add and subtract fractions.** • 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. Solve word problems involving addition and subtraction of fractions referring to the same whole, including cases of unlike denominators, e.g., by using visual fraction models or equations to represent the problem. Use benchmark fractions and number sense of fractions to estimate mentally and assess the reasonableness of answers. For example, recognize an incorrect result 2/5 + 1/2 = 3/7, by observing that 3/7 < 1/2. **5.MD** **Represent and interpret data.** • 2. Make a line plot to display a data set of measurements in fractions of a unit ($1/2$, $1/4$, $1/8$). Use operations on fractions for this grade to solve problems involving information presented in line plots. *For example, given different measurements of liquid in identical beakers, find the amount of liquid each beaker would contain if the total amount in all the beakers were redistributed equally.*	• Use equivalency to add and subtract fractions • Solve problems with fractional quantities involving addition and subtraction • Write expressions for calculations with fractions • Represent and interpret data through line plots	MP.4. Model with mathematics
January – February	Number and Operations-Fractions	**5.NF** **Apply and extend previous understandings of multiplication and division to multiply and divide fractions.** • 3. Interpret a fraction as division of the numerator by the denominator (a/b = a ¸ b). Solve word problems involving division of whole numbers leading to answers in the form of fractions or mixed	• Understand concept of multiplying fractions by fractions	MP.2. Reason abstractly and quantitatively.

		numbers, e.g., by using visual fraction models or equations to represent the problem. For example, interpret ¾ 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 ¾. 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? • 4. Apply and extend previous understandings of multiplication to multiply a fraction or whole number by a fraction. a. Interpret the product (a/b) ´ q as a parts of a partition of q into b equal parts; equivalently, as the result of a sequence of operations a ´ q ¸ b. For example, use a visual fraction model to show (2/3) ´ 4 = 8/3, and create a story context for this equation. Do the same with (2/3) ´ (4/5) = 8/15 . (In general, (a/b) ´ (c/d) = ac/bd.) b. Find the area of a rectangle with fractional side lengths by tiling it with unit squares of the appropriate unit fraction side lengths, and show that the area is the same as would be found by multiplying the side lengths. Multiply fractional side lengths to find areas of rectangles, and represent fraction products as rectangular areas. • 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	• Use visual models to represent multiplication and division of fractions • Solve real-world problems involving multiplication and division of fractions • Measure objects to 1/8 of a unit	

		numbers greater than 1 as a familiar case); explaining why multiplying a given number by a fraction less than 1 results in a product smaller than the given number; and relating the principle of fraction equivalence a/b = (n ´ a)/ (n ´ b) to the effect of multiplying a/b by 1. • 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. • 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 non-zero whole number, and compute such quotients. For example, create a story context for (1/3) ¸ 4, and use a visual fraction model to show the quotient. Use the relationship between multiplication and division to explain that (1/3) ¸ 4 = 1/12 because (1/12) ´ 4 = 1/3. b. Interpret division of a whole number by a unit fraction, and compute such quotients. For example, create a story context for 4 ¸ (1/5), and use a visual fraction model to show the quotient. Use the relationship between multiplication and division to explain that 4 ¸ (1/5) = 20 because 20 ´ (1/5) = 4. c. Solve real-world problems involving division of unit fractions by non-zero whole numbers and 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 ½ lb of chocolate equally? How many 1/3-cup servings are in 2		

	Measurement and Data	cups of raisins? **5.MD** **Represent and interpret data.** • 2. Make a line plot to display a data set of measurements in fractions of a unit (1/2, 1/4, 1/8). Use operations on fractions for this grade to solve problems involving information presented in line plots. For example, given different measurements of liquid in identical beakers, find the amount of liquid each beaker would contain if the total amount in all the beakers were redistributed equally.		
March – April	Geometry Measurement and Data	**5.G** **Classify two-dimensional figures into categories based on their properties.** • 3. Understand that attributes belonging to a category of two-dimensional figures also belong to all subcategories of that category. For example, all rectangles have four right angles and squares are rectangles, so all squares have four right angles. • 4. Classify two-dimensional figures in a hierarchy based on properties. **5.MD** **Geometric measurement: Understand concepts of volume and relate volume to multiplication and to addition.** • 3. Recognize volume as an attribute of solid figures and understand concepts of volume measurement. a. A cube with side length 1 unit, called a "unit cube," is said to have "one cubic unit" of volume, and can be used to measure volume. b. A solid figure which can be packed without gaps or overlaps using n unit cubes is said to have a volume of n cubic units. • 4. Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft, and improvised units. • 5. Relate volume to the operations of	• Classify two dimensional geometric figures • Understand and measure volume • Solve problems involving volume using a formula • Write expressions for finding	MP.5. Use appropriate tools strategically

		multiplication and addition and solve real-world and mathematical problems involving volume. a. Find the volume of a right rectangular prism with whole-number side lengths by packing it with unit cubes, and show that the volume is the same as would be found by multiplying the edge lengths, equivalently by multiplying the height by the area of the base. Represent threefold whole-number products as volumes, e.g., to represent the associative property of multiplication. b. Apply the formulas V = l ´ w ´ h and V = b ´ h for rectangular prisms to find volumes of right rectangular prisms with whole-number edge lengths in the context of solving real-world and mathematical problems. c. Recognize volume as additive. Find volumes of solid figures composed of two non-overlapping right rectangular prisms by adding the volumes of the non-overlapping parts, applying this technique to solve real-world problems.	volume	
May – June	Operations and Algebraic Thinking	**5.OA** **Write and interpret numerical expressions.** • 1. Use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols. • 2. Write simple expressions that record calculations with numbers, and interpret numerical expressions without evaluating them. For example, express the calculation "Add 8 and 7, then multiply by 2" as 2 ´ (8 + 7). Recognize that 3 ´ (18932 + 921) is three times as large as 18932 + 921, without having to calculate the indicated sum or product. **Analyze patterns and relationships.** • 3. Generate two numerical patterns using two given rules. Identify apparent relationships between corresponding terms. Form ordered pairs	• Evaluate and write expressions with parentheses • Represent algebraic thinking • Generate numerical patterns using two given rules	MP.7. Look for and make sense of structure.

		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.		
	The Number System	**5.NS** **Gain familiarity with concepts of positive and negative integers.** MA.1. Use positive and negative integers to describe quantities such as temperature above/below zero, elevation above/below sea level, or credit/debit.	• Understand positive and negative integers	
	Geometry	**5.G** **Graph points on the coordinate plane to solve real-world and mathematical problems.** • 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). • 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.	• Explore the coordinate plane	

Grade 6 Mathematics Curriculum Map

Timeline/Teacher notes on progress	Topic	Standards	Content/Skills	Standards for Mathematical Practice
September	Expressions and Equations	**6.EE** **Apply and extend previous understandings of arithmetic to algebraic expressions.** • 1. Write and evaluate numerical expressions involving whole-number exponents. • 2. Write, read, and evaluate expressions in which letters stand for numbers. a. Write expressions that record operations with numbers and with letters standing for numbers. For example, express the calculation "Subtract y from 5" as 5 – y. b. Identify parts of an expression using mathematical terms (sum, term, product, factor, quotient, coefficient); view one or more parts of an expression as a single entity. For example, describe the expression 2 (8 + 7) as a product of two factors; view (8 + 7) as both a single entity and a sum of two terms. c. Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used in real-world problems. Perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations). For example, use the formulas V = s3 and A = 6s2 to find the volume and surface area of a cube with sides of length s = ½. • 3. Apply the properties of operations to generate equivalent expressions. For example, apply the distributive property to the expression 3 (2 + x) to produce the equivalent expression 6 + 3x;	• Combine like terms • Expand and factor expressions • Evaluate numerical expressions	MP.1. Make sense of problems and persevere in solving them MP.2. Reason abstractly and quantitatively MP.6. Attend to Precision

		apply the distributive property to the expression 24x + 18y to produce the equivalent expression 6(4x + 3y); apply properties of operations to y + y + y to produce the equivalent expression 3y. • 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.	• Identify equivalent expressions	
October - November	The Number System	**6.NS** **Apply and extend previous understandings of multiplication and division to divide fractions by fractions.** • 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 $(2/3) \div (3/4)$ and use a visual fraction model to show the quotient; use the relationship between multiplication and division to explain that $(2/3) \div (3/4) = 8/9$ because $3/4$ of $8/9$ is $2/3$.* (In general, $(a/b) \div (c/d) = ad/bc$.) *How much chocolate will each person get if 3 people share $1/2$ lb of chocolate equally? How many $3/4$-cup servings are in $2/3$ of a cup of yogurt? How wide is a rectangular strip of land with length $3/4$ mi and area $1/2$ square mi?* **Compute fluently with multi-digit numbers and find common factors and multiples.** • 2. Fluently divide multi-digit numbers using the standard algorithm. • 3. Fluently add, subtract, multiply, and divide multi-digit decimals using the standard	• Divide fractions • Multiply fractions • Add, subtract, multiply and divide multi-digit decimals using the standard algorithm	MP.2. Reason abstractly and quantitatively MP.4. Model with mathematics MP.6. Attend to Precision

		algorithm for each operation. • 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*). MA.4.a. Apply number theory concepts, including prime factorization and relatively prime numbers, to the solution of problems.	• Find the greatest common factor of two numbers • Find the least common multiple of two numbers • Identify relatively prime numbers • Find the prime factorization of a given number	
November - December	Rates, Ratios and Proportions	**6.RP** **Understand ratio concepts and use ratio reasoning to solve problems.** • 1. Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. *For example, "The ratio of wings to beaks in the bird house at the zoo was 2:1, because for every 2 wings there was 1 beak." "For every vote candidate A received, candidate C received nearly three votes."* • 2. Understand the concept of a unit rate a/b associated with a ratio $a:b$ with $b \neq 0$, and use rate language in the context of a ratio relationship. *For example, "This recipe has a ratio of 3 cups of flour to 4 cups of sugar, so there is ¾ cup of flour for each cup of sugar." "We paid $75 for 15 hamburgers, which is a rate of $5 per hamburger."* • 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	• Identify relationship between two quantities • Calculate unit rate • Find percent of quantity • To determine equivalent ratios • Convert units of measure using ratios	MP.2. Reason abstractly and quantitatively MP.4. Model with mathematics

		measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios. b. Solve unit rate problems, including those involving unit pricing and constant speed. *For example, if it took 7 hours to mow 4 lawns, then, at that rate, how many lawns could be mowed in 35 hours? At what rate were lawns being mowed?* c. Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means **30/100** times the quantity); solve problems involving finding the whole, given a part and the percent. d. Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities. MA.3.e. Solve problems that relate the mass of an object to its volume.		
January	Geometry	**6.G** **Solve real-world and mathematical problems involving area, surface area, and volume.** • 1. Find the area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques in the context of solving real-world and mathematical problems. MA.1.a. Use the relationships among radius, diameter, and center of a circle to find its circumference and area. MA.1.b. Solve real-world and mathematical problems involving the measurements of circles.	• Calculate area • Calculate perimeter or circumference	MP.1. Make sense of problems and persevere in solving them.

		• 2. Find the volume of a right rectangular prism with fractional edge lengths by packing it with unit cubes of the appropriate unit fraction edge lengths, and show that the volume is the same as would be found by multiplying the edge lengths of the prism. Apply the formulas $V = lwh$ and $V = bh$ to find volumes of right rectangular prisms with fractional edge lengths in the context of solving real-world and mathematical problems. • 4. Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface areas of these figures. Apply these techniques in the context of solving real-world and mathematical problems.	• Calculate volume of a rectangular prism • Use nets to find surface area of polyhedrons	
February – March	The Number System	**6.NS** **Apply and extend previous understandings of numbers to the system of rational numbers.** • 5. Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation. • 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	• Recognize that opposite signs of numbers indicate locations which are on opposite sides of zero on the number line • Use a number line to plot and order integers • Find and position pairs of integers on a coordinate plane • Name and identify the characteristics of each quadrant on a coordinate plane • Measure the horizontal or vertical distance between points on a coordinate plane	MP.2. Reason abstractly and quantitatively MP.4. Model with mathematics. MP.5. Use appropriate tools strategically.

		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. • 7. Understand ordering and absolute value of rational numbers. a. Interpret statements of inequality as statements about the relative positions of two numbers on a number line diagram. *For example, interpret –3 > –7 as a statement that –3 is located to the right of –7 on a number line oriented from left to right.* b. Write, interpret, and explain statements of order for rational numbers in real-world contexts. *For example, write –3°C > –7°C to express the fact that –3°C is warmer than –7°C.* c. Understand the absolute value of a rational number as its distance from 0 on the number line; interpret absolute value as magnitude for a positive or negative quantity in a real-world situation. *For example, for an account balance of –30 dollars, write |–30| = 30 to describe the size of the debt in dollars.* d. Distinguish comparisons of absolute value from statements about order. *For example, recognize that an account balance less than –30 dollars represents a debt greater than 30 dollars.* • 8. Solve real-world and mathematical problems by graphing points in all four quadrants of the coordinate plane. Include use of coordinates and	• Statements of inequalities • Understand and compare absolute value of rational numbers • Construct a graph using a coordinate plane	

	Expression and Equations Geometry	absolute value to find distances between points with the same first coordinate or the same second coordinate **6.EE** **Represent and analyze quantitative relationships between dependent and independent variables.** • 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.* **6.G** **Solve real-world and mathematical problems involving area, surface area, and volume.** • 3. Draw polygons in the coordinate plane given coordinates for the vertices; use coordinates to find the length of a side joining points with the same first coordinate or the same second coordinate. Apply these techniques in the context of solving real-world and mathematical problems.	• Write an equation that relates an independent and dependent variable • Determine an appropriate scale for a set of data	
April	Expressions and Equations	**6.EE** **Reason about and solve one-variable equations and inequalities.** • 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.	• Solve equations • Rewrite equations and inequalities to make them true	MP.2. Reason abstractly and quantitatively MP.4. Model with mathematics MP.6. Attend to precision

		• 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. • 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. • 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.	• Construct flowcharts to represent input/output tables and equations • Use mental math, guess, check, and revise strategies to find solutions of inequalities • Write and graph inequalities	
May – June	Statistics and Probability	**6.SP** **Develop understanding of statistical variability.** • 2. Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape. • 3. Recognize that a measure of center for a numerical data set summarizes all of its values with a single number, while a measure of variation describes how its values vary with a single number. **Summarize and describe distributions.** • 4. Display numerical data in plots on a number line, including dot plots, histograms, and box plots. MA.4.a. Read and interpret circle graphs.	• Recognize statistical questions • Describe a distribution by its center, spread, and shape • Graph data on a number line, dot plot histogram, and box plot. • Summarize numerical data sets in relation to their context	MP.1. Make sense of problems and persevere in solving them MP.3. Construct viable arguments and critique the reasoning of others MP.4. Model with mathematics

Grade 7 Mathematics Curriculum Map

Timeline/Teacher notes on progress	Topic	Standards	Content/Skills	Standards for Mathematical Practice
September – October	Ratios and Proportional Relationships	**7.RP** **Analyze proportional relationships and use them to solve real-world and mathematical problems.** • 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 ½ mile in each ¼ hour, compute the unit rate as the complex fraction ½/¼ miles per hour, equivalently 2 miles per hour.* • 2. Recognize and represent proportional relationships between quantities. 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. c. Represent proportional relationships by equations. *For example, if total cost t is proportional to the number n of items purchased at a constant price p, the relationship between the total cost and the number of items can be expressed*	• Calculate and recognize an equivalent ratio • Positive rational numbers and complex fractions • Create a ratio table • Set up a proportion	MP.1. Make sense of problems and persevere in solving them MP.2. Reason abstractly and quantitatively MP.6. Attend to Precision
	The Number System	**7.NS**		

	Geometry	**Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.** • 2. Apply and extend previous understandings of multiplication and division and of fractions 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. • 3. Solve real-world and mathematical problems involving the four operations with rational numbers **7.G** **Draw, construct, and describe geometrical figures and describe the relationships between them.** • 1. Solve problems involving scale drawings of geometric figures, such as computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.	• Calculate products and quotients of rational numbers • Addition, subtraction, multiplication, and division of rational numbers • Calculate the scale factor given two similar figures	
October - November	The Number System	**7.NS** **Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.** • 1. Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a horizontal or vertical number line diagram. a. Describe situations in which opposite quantities combine to make 0. *For example, a hydrogen atom has 0 charge because its two constituents are oppositely charged.* b. Understand $p + q$ as the number located a distance $\|q\|$ from p, in the positive or negative direction depending on whether q is positive or negative. Show that a	• Calculate sums and differences of rational numbers	MP.1. Make sense of problems and persevere in solving them MP.2. Reason abstractly and quantitatively MP. 5. Use appropriate tools strategically

	Ratios and Proportional Relationship	number and its opposite have a sum of 0 (are additive inverses). Interpret sums of rational numbers by describing real-world contexts. c. Understand subtraction of rational numbers as adding the additive inverse, $p - q = p + (-q)$. Show that the distance between two rational numbers on the number line is the absolute value of their difference, and apply this principle in real-world contexts. d. Apply properties of operations as strategies to add and subtract rational numbers. **7.RP** **Analyze proportional relationships and use them to solve real-world and mathematical problems.** • 3. Use proportional relationships to solve multi-step ratio and percent problems. *Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error.*	• Use proportional relationships for solving ratios and percents	
December – January	Expressions and Equations	**7.EE** **Use properties of operations to generate equivalent expressions.** • 1. Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients. • 2. Understand that rewriting an expression in different forms in a problem context can shed light on the problem and how the quantities in it are related. *For example, a + 0.05a = 1.05a means that "increase by 5%" is the same as "multiply by 1.05."* **Solve real-life and mathematical problems using numerical and algebraic expressions and equations.** • 3. Solve multi-step real-life and mathematical problems posed with positive and	• Linear expressions with rational coefficients • Simplify expressions using the order of operations • Positive and negative rational numbers	MP.2. Reason abstractly and quantitatively MP.4. Model with mathematics MP. 5. Use appropriate tools strategically

		negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. *For example: If a woman making $25 an hour gets a 10% raise, she will make an additional* ***1/10*** *of her salary an hour, or $2.50, for a new salary of $27.50. If you want to place a towel bar 9¾ inches long in the center of a door that is 27½ 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.* • 4. Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. a. Solve word problems leading to equations of the form $px + q = r$ and $p(x \div q) = r$, where p, q, and r are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach. *For example, the perimeter of a rectangle is 54 cm. Its length is 6 cm. What is its width?* b. Solve word problems leading to inequalities of the form $px + q > r$ or $px + q < r$, where p, q, and r are specific rational numbers. Graph the solution set of the inequality and interpret it in the context of the problem. *For example: As a salesperson, you are paid $50 per week plus $3 per sale. This week you want your*	• Translate word problems into algebraic expressions or equations • Solve equations with a variable on one side • Solve inequalities with a variable on one side	

		pay to be at least $100. Write an inequality for the number of sales you need to make, and describe the solutions. MA.4.c. Extend analysis of patterns to include analyzing, extending, and determining an expression for simple arithmetic and geometric sequences (e.g., compounding, increasing area), using tables, graphs, words, and expressions.		
February	Geometry	**7.G** **Draw, construct, and describe geometrical figures and describe the relationships between them.** • 2. Draw (freehand, with ruler and protractor, and with technology) geometric shapes with given conditions. Focus on constructing triangles from three measures of angles or sides, noticing when the conditions determine a unique triangle, more than one triangle, or no triangle. • 3. Describe the two-dimensional figures that result from slicing three-dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids. **Solve real-life and mathematical problems involving angle measure, area, surface area, and volume.** • 4. Know the formulas for the area and circumference of a circle and solve problems; give an informal derivation of the relationship between the circumference and area of a circle. • 5. Use facts about supplementary, complementary, vertical, and adjacent angles in a multi-step problem to write and use them to solve simple equations for an unknown angle in a figure. • 6. Solve real-world and mathematical problems involving area, volume, and surface area	• Draw geometric shapes given specific conditions • Describe two-dimensional figures that result from slicing 3-D figures • Identify formulas for perimeter, area, surface area and volume • Identify supplementary, complementary, vertical and adjacent angles • Apply formulas for perimeter, area, surface area	MP.4. Model with mathematics MP.5. Use appropriate tools strategically MP.7. Look for and make use of structure

		of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms. MA.7. Solve real-world and mathematical problems involving the surface area of sphere	and volume	
March	Statistics and Probability	**7.SP** **Investigate chance processes and develop, use, and evaluate probability models.** • 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 ½ indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event. • 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.* • 7. Develop a probability model and use it to find probabilities of events. Compare probabilities from a model to observed frequencies; if the agreement is not good, explain possible sources of the discrepancy. a. Develop a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events. *For example, if a student is selected at random from a class, find the probability that Jane will be selected and the probability that a girl will be selected.*	• Probability of a chance event • Collect data and predict relative frequency • Given a simple event, develop a probability model to predict or ding the likelihood of an event	MP.3. Construct viable arguments and critique the reasoning of others MP.4. Model with mathematics

	Ratios and Proportional Relationships	b. Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process. For example, find the approximate probability that a spinning penny will land heads up or that a tossed paper cup will land open-end down. Do the outcomes for the spinning penny appear to be equally likely based on the observed frequencies? **7.RP** **Analyze proportional relationships and use them to solve real-world and mathematical problems.** • 3. Use proportional relationships to solve multi-step ratio and percent problems. *Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error.*	• Application of percents with probability	
April	Statistics and Probability	**7.SP** **Investigate chance processes and develop, use, and evaluate probability models.** • 8. Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation. a. Understand that, just as with simple events, the probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs. b. Represent sample spaces for compound events using methods such as organized lists, tables, and tree diagrams. For an event described in everyday language (e.g., "rolling double sixes"), identify the outcomes in the sample space which compose the event. c. Design and use a simulation to generate frequencies for compound events. *For*	• Given a simple event, use organized lists, tables, tree diagrams and simulation to find the probability	MP.4. Model with mathematics MP.5. Use appropriate tools strategically MP.6. Attend to Precision

		example, use random digits as a simulation tool to approximate the answer to the question: If 40% of donors have type A blood, what is the probability that it will take at least 4 donors to find one with type A blood?		
	Ratios and Proportional Relationships	**7.RP** **Analyze proportional relationships and use them to solve real-world and mathematical problems.** • 3. Use proportional relationships to solve multi-step ratio and percent problems. *Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error.*	• Application of percents with probability	
May – June	Statistics and Probability	**7.SP** **Use random sampling to draw inferences about a population.** • 1. Understand that statistics can be used to gain information about a population by examining a sample of the population; generalizations about a population from a sample are valid only if the sample is representative of that population. Understand that random sampling tends to produce representative samples and support valid inferences. • 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.* **Draw informal comparative inferences about two populations.** • 3. Informally assess the degree of visual	• Generate a sample that best represents a population • Develop a probability model to predict or find the likelihood of simple and compound events • Use organized lists, tables,	MP.3. Construct viable arguments and critique the reasoning of others MP.4. Model with mathematics MP.6. Attend to precision

		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. 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.*	tree diagrams and simulation to find the probability of simple and compound events • Find measures of center and variability to interpret and compare data sets and/or populations	

Grade 8 Mathematics Curriculum Map

Timeline/Teacher notes on progress	Topic	Standards	Content/Skills	Standards for Mathematical Practice
September – October	The Number System	**8.NS** **Know that there are numbers that are not rational, and approximate them by rational numbers.** • 1. Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational	• Classify a number as rational or irrational	MP.1. Make sense of problems and persevere in solving them. MP.4. Model with mathematics. MP.8. Look for and

	Expressions and Equations	number. • 2. Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., π^2). *For example, by truncating the decimal expansion of* $\sqrt{2}$ *show that* $\sqrt{2}$ *is between 1 and 2, then between 1.4 and 1.5, and explain how to continue on to get better approximations.* **8.EE** **Work with radicals and integer exponents.** • 1. Know and apply the properties of integer exponents to generate equivalent numerical expressions. *For example,* $3^2 \times 3^{-5} = 3^{-3} = 1/3^3 = 1/27$. • 2. Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that $\sqrt{2}$ is irrational. • 3. Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other. *For example, estimate the population of the United States as* 3×10^8 *and the population of the world as* 7×10^9*, and determine that the world population is more than 20 times larger.* • 4. Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology.	• Identify the location of an irrational number on the number line • Find equivalent expressions when using the properties of integer exponents • Square root and cube root as representations for equation solutions • Represent small and large quantities in scientific notation • Perform operations with numbers expressed in scientific notation (decimal and scientific notation	express regularity in repeated reasoning.

	Geometry	**8.G** **Understand and apply the Pythagorean Theorem.** • 6. Explain a proof of the Pythagorean Theorem and its converse. • 7. Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions. • 8. Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.	• Pythagorean Theorem • Find the side lengths of right triangles • Find the distance between two points	
November – December	Expressions and Equations Functions	**8.EE** **Understand the connections between proportional relationships, lines, and linear equations.** • 5. Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. *For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.* • 6. Use similar triangles to explain why the slope *m* is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation $y = mx$ for a line through the origin and the equation $y = mx + b$ for a line intercepting the vertical axis at *b*. **8.F** **Use functions to model relationships between quantities.** • 4. Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (*x, y*) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the	• Transform a given equation into simpler form to determine the number of solutions • Calculate slope using similar triangles • Translate between equations, tables, graphs and verbal descriptions	MP.3 Construct viable arguments and critique the reasoning of others. MP.4. Model with mathematics. MP.5. Use appropriate tools strategically.

	Statistics and Probability	situation it models, and in terms of its graph or a table of values. **8.SP** **Investigate patterns of association in bivariate data.** • 1. Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association. • 2. Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line. • 3. Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. *For example, in a linear model for a biology experiment, interpret a slope of 1.5 cm/hr as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height.*	• Construct a scatterplot • Determine patterns: clustering, outliers, positive or negative association, linear and non-linear association in a scatterplot • Draw line of best fit • Determine the equation of line of best fit • Use line of best fit equation to solve problems	
January – February	Expressions and Equations	**8.EE** **Analyze and solve linear equations and pairs of simultaneous linear equations.** • 7. Solve linear equations in one variable. a. Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form $x = a$, $a = a$, or $a = b$ results (where a and b are different numbers). b. Solve linear equations with rational number coefficients, including equations whose	• Identifying linear equations • Solving linear equations	MP.1. Make sense of problems and persevere in solving them. MP.6. Attend to precision. MP.7 Look for and make use of structure.

		solutions require expanding expressions using the distributive property and collecting like terms. • 8. Analyze and solve pairs of simultaneous linear equations. a. Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously. b. Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection. *For example, 3x + 2y = 5 and 3x + 2y = 6 have no solution because 3x + 2y cannot simultaneously be 5 and 6.* c. 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.*	• Estimating solutions to systems of equations by graphing • Solve systems of equations algebraically • Determine the number of solutions to a system of equations	
March	Functions	**8.F** **Define, evaluate, and compare functions.** • 1. Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output. • 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.* • 3. Interpret the equation *y = mx + b* as defining a linear function whose graph is a straight	• Determine a function from a graph using the vertical line test • Identify a linear function • Linear and non-linear functions	MP.1. Make sense of problems and persevere in solving them. MP.2. Reason abstractly and quantitatively.

		line; give examples of functions that are not linear. *For example, the function $A = s^2$ giving the area of a square as a function of its side length is not linear because its graph contains the points (1, 1), (2, 4) and (3, 9), which are not on a straight line.* **Use functions to model relationships between quantities.** • 5. Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.	• Graphing a function • Provide a description of the relationship between two quantities on a graph	
April – May	Geometry	**8.G** **Understand congruence and similarity using physical models, transparencies, or geometry software.** • 1. Verify experimentally the properties of rotations, reflections, and translations: a. Lines are taken to lines, and line segments to line segments of the same length. b. Angles are taken to angles of the same measure. c. Parallel lines are taken to parallel lines. • 2. Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them. • 3. Describe the effects of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates. • 4. Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a	• Rotate, reflect, and translate a figure on a coordinate plane • Congruent two-dimensional figures given rotation, reflection, and translation • Identify coordinates of 2D figures when dilated, translated, or rotated • 2D figure similarity by sequences	MP.3 Construct viable arguments and critique the reasoning of others. MP.5. Use appropriate tools strategically. MP.6. Attend to precision. MP.7 Look for and make use of structure.

		sequence that exhibits the similarity between them. • 5. Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles. *For example, arrange three copies of the same triangle so that the sum of the three angles appears to form a line, and give an argument in terms of transversals why this is so.* **Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres.** • 9. Know the formulas for the volumes of cones, cylinders, and spheres, and use them to solve real-world and mathematical problems.	• Angle sum and exterior angle theorems of triangles • Volume of cones, cylinders, and spheres	
June	Statistics and Probability	**8.SP** **Investigate patterns of association in bivariate data.** • 4. Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables. *For example, collect data from students in your class on whether or not they have a curfew on school nights and whether or not they have assigned chores at home. Is there evidence that those who have a curfew also tend to have chores?*	• Construct a two way table • Interpret a two way table • Relative frequency between two variables	

Grade 9 Mathematics Curriculum Map- Algebra I

Timeline/Teacher notes on progress	Topic	Standards	Content/Skills	Standards for Mathematical Practice
September – October	Algebra - Seeing structure in equations A-SSE	**Interpret the structure of expressions.** 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.* 2. Use the structure of an expression to identify ways to rewrite it. *For example, see $x^4 – y^4$ as $(x^2)^2 – (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 – y^2)(x^2 + y^2)$.*	• Interpret expressions • Rewrite expressions	MP.1. Make sense of problems and persevere in solving them MP.2. Reason abstractly and quantitatively MP.6. Attend to Precision MP.7. Look for and make use of structure
	Numbers and quantity - The Real Number system N-RN	**Extend the properties of exponents to rational exponents.** 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 $5^{1/3}$ to be the cube root of 5 because we want $(5^{1/3})^3 = 5^{(1/3)3}$ to hold, so $(5^{1/3})^3$ must equal 5.* 2. Rewrite expressions involving radicals and rational exponents using the properties of exponents. **Use properties of rational and irrational numbers.** 3. Explain why the sum or product of two rational	• Explain rational exponents • Rewrite expressions • Explain properties of rational/irrational numbers	MP.1. Make sense of problems and persevere in solving them MP.2. Reason abstractly and quantitatively MP.6. Attend to Precision

		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		
October - November	Arithmetic – Arithmetic with Polynomials and Rational Expressions A-APR	**Perform arithmetic operations on polynomials.** 1. Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.	• Demonstrate understanding of polynomials • Operations	MP.2. Reason abstractly and quantitatively
	Algebra - Creating equations A-CED	**Create equations that describe numbers or relationships.** 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. 2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. 3. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.*	• Create equations with one variable • Solve inequalities • Create equations with two or more variables • Graph equations • Represent quantitative relationships	MP.1. Make sense of problems and persevere in solving them MP.2. Reason abstractly and quantitatively MP.4. Model with mathematics MP.6. Attend to Precision MP.7. Look for and make use of structure
December	Algebra – Reasoning with Equations and Inequalities A-REI	**Write expressions in equivalent forms to solve problems.** 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	• Explain steps in solving equations • Solve equations • Give examples of other solutions	MP.1. Make sense of problems and persevere in solving them MP.2. Reason

		zeros of the function it defines. b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines. c. Use the properties of exponents to transform expressions for exponential functions. *For example, the expression* 1.15^t *can be rewritten as* $(1.15^{1/12})^{12t} \approx 1.012^{12t}$ *to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.*	• Solve linear equations • Solve quadratic equations • Derive formulas • Factoring • Square roots	abstractly and quantitatively
	Numbers and Quantities – The Complex Number System N-CN	**Perform arithmetic operations with complex numbers.** 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. 2. Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers. 3. (+)[i] Find the conjugate of a complex number; use conjugates to find moduli and quotients of complex numbers.	• Identify complex numbers • Use commutative, associative and distributive properties • Perform operations with complex numbers • Conjugates	MP.1. Make sense of problems and persevere in solving them MP.2. Reason abstractly and quantitatively MP.6. Attend to precision
January - February	Algebra – Reasoning with Equations and Inequalities A-REI	**Understand solving equations as a process of reasoning and explain the reasoning.** 1. Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method. **Solve equations and inequalities in one variable.** 3. Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters. MA.3.a. Solve linear equations and inequalities in one variable involving absolute value. 4. Solve quadratic equations in one variable.	• Explain steps of loving equations • Solve systems of equations • Solve linear equations with one variable • Solve and derive quadratic equations • Solve graphically and algebraically • Solve systems of equations with two variables • Approximate solutions	MP.1. Make sense of problems and persevere in solving them MP.2. Reason abstractly and quantitatively MP.3.Construct viable arguments and critique the reasoning of others MP.4. Model with mathematics

		a. Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x – p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form. b. Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula, and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers a and b. **Solve systems of equations.** 5. Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions. 6. Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables. 7. Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. *For example, find the points of intersection between the line $y = –3x$ and the circle $x^2 + y^2 = 3$.*		MP.5. Use appropriate tools strategically MP.7. Look for and make use of structure
March	Algebra – Arithmetic with Polynomials and Rational Expressions A-APR	**Understand the relationship between zeros and factors of polynomials.** 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 $p(x)$. 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.	• Apply the Remainder Theorem • Graph functions defined by polynomials	MP.1. Make sense of problems and persevere in solving them MP.2. Reason abstractly and quantitatively MP.6. Attend to

				Precision
	Algebra – Reasoning with Equations and Inequalities A-REI	**Represent and solve equations and inequalities graphically.** 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). 11. Explain why the *x*-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions. ★ 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.	• Graph equations and solutions • Make tables • Explain solutions • Use technology	MP.1.Make sense of problems and persevere in solving them. MP.4. Model with mathematics. MP.5.Use appropriate tools strategically. MP.6.Attend to precision.
April	Functions – Interpreting Functions F-IF	**Understand the concept of a function and use function notation.** 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 $y = f(x)$. 2. Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context. 3. Recognize that sequences are functions,	• Define functions • Use function notation • Evaluate and interpret functions • Identify sequences as functions • Interpret graphs • Demonstrate key features of function relationships • Relate domains of functions to quantitative relationships • Calculate and interpret function rate of change	MP.1.Make sense of problems and persevere in solving them. MP.2.Reason abstractly and quantitatively. MP.4. Model with mathematics. MP.5.Use appropriate tools strategically.

		sometimes defined recursively, whose domain is a subset of the integers. *For example, the Fibonacci sequence is defined recursively by f(0) = f(1) = 1, f(n + 1) = f(n) + f(n – 1) for n ≥ 1.* **Interpret functions that arise in applications in terms of the context.** 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.* 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 the positive integers would be an appropriate domain for the function.* ★ 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. ★		MP.6.Attend to precision.
May	Functions – Interpreting Functions F-IF	**Analyze functions using different representations.** 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. ★ e. Graph exponential and logarithmic	• Graph linear, and quadratic functions, • Graph square/cube roots functions • Graph exponential and logarithmic functions • Graph trigometric functions • Write functions defined by expressions • Explain properties of	MP.1.Make sense of problems and persevere in solving them. MP.2.Reason abstractly and quantitatively. MP.4. Model with mathematics. MP.5.Use appropriate tools strategically.

		functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude. ★ 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 = $(0.97)^t$,*** 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.*	functions • Factoring • Square • Interpret results • Represent comparisons in a variety of methods	MP.6.Attend to precision.
	Functions – Interpreting Functions F-BF	**Build a function that models a relationship between two quantities.** 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.* ★ 2. Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate	• Write functions • Determine expressions, processes or steps for calculation • Combine function types • Use operations • Write sequences • Model situations • Translate • Identify, on a graph, the effects of replacing value • Find values • Experiment with different cases • Use technology to illustrate	MP.1.Make sense of problems and persevere in solving them. MP.2.Reason abstractly and quantitatively. MP.4. Model with mathematics. MP.5.Use appropriate tools strategically. MP.6.Attend to precision MP.7.Look for and make use of

		between the two forms. ★ **Build new functions from existing functions.** 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.* 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. F*or example, $f(x) = 2x^3$ or $f(x) = (x + 1)/(x – 1)$ for $x \neq 1$*	explanations • Inverse functions • Solve equations • Write expressions	structure. MP.8.Look for an express regularity in repeated reasoning. .
June	Statistics and Probability – Interpreting Categorical and Quantitative Data S-ID	**Summarize, represent, and interpret data on a single count or measurement variable.** 1. Represent data with plots on the real number line (dot plots, histograms, and box plots). ★ 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. ★ 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. 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. ★ **Summarize, represent, and interpret data on two categorical and quantitative variables.**	• Represent data • Use statistics to approximate • Compare center and spread • Use mean and standard deviation of data • Estimate percentages • Use tools/technology • Summarize data • Interpret data • Recognize associations/trends • Fit functions to data • Solve problems in context of data • Emphasize models • Assess fit of functions • Analyze residuals • Scatter plots • Interpret slope and intercept • Correlation vs. causation	MP.1.Make sense of problems and persevere in solving them. MP.2.Reason abstractly and quantitatively. MP.4. Model with mathematics. MP.5.Use appropriate tools strategically. MP.6.Attend to precision MP.7.Look for and make use of structure. MP.8.Look for an express regularity in repeated reasoning.

		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. ★ 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. ★ c. Fit a linear function for a scatter plot that suggests a linear association. ★ **Interpret linear models.** 7. Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data. ★ 8. Compute (using technology) and interpret the correlation coefficient of a linear fit. ★ 9. Distinguish between correlation and causation. ★		

Grade 10 Mathematics Curriculum Map-Geometry

Timeline/Teacher notes on progress	Topic	Standards	Content/Skills	Standards for Mathematical Practice
September – October	Number and Quantity - Quantities N-Q	**Reason quantitatively and use units to solve problems.** 2. Define appropriate quantities for the purpose of descriptive modeling. 3. Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. ★ MA.3.a. Describe the effects of approximate error in measurement and rounding on measurements and on computed values from measurements. Identify significant figures in recorded measures and computed values based on the context given and the precision of the tools used to measure. ★	• Define quantities • Identify limitations • Significant figures • Evaluate precision of mathematical tools	MP.1. Make sense of problems and persevere in solving them MP.2. Reason abstractly and quantitatively MP.5.Use appropriate tools strategically. MP.6. Attend to Precision
	Geometry – Congruence G-CO	**Experiment with transformations in the plane.** 1. Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc. 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). 3. Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations	• Define geometric terms • Represent, describe and compare transformations in the plane • Describe rotations/reflections of polygons	MP.1. Make sense of problems and persevere in solving them MP.2. Reason abstractly and quantitatively M. 4.Model with mathematics. MP.5.Use appropriate tools Strategically.

		and reflections that carry it onto itself.		MP.6. Attend to Precision MP.7.Look for and make use of structure.
October - November	Geometry - Congruence G-CO	**Experiment with transformations in the plane.** 4. Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments. 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.	• Develop definitions of geometric terms • Draw transformed figures	MP.1. Make sense of problems and persevere in solving them MP.2. Reason abstractly and quantitatively MP.5.Use appropriate tools strategically. MP.6. Attend to Precision
	Geometry - Congruence G-CO	**Understand congruence in terms of rigid motions.** 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. 7. Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent. 8. Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions.	• Apply geometric definitions • Predict effects of rigid motion • Determine congruence • Congruent triangles/angles • Explain criteria for congruence	MP.1. Make sense of problems and persevere in solving them MP.2. Reason abstractly and quantitatively MP.3.Construct viable arguments and critique the reasoning of others. MP.6. Attend to Precision MP.7.Look for and

				make use of structure.
December – January	Geometry – Congruence G-CO	**Prove geometric theorems.** 9. 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.* 10. Prove theorems about triangles. *Theorems include: measures of interior angles of a triangle sum to 180°; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point.* 11. 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.*	• Prove theorems (lines, angles, triangles, parallelograms, polygons)	MP.1. Make sense of problems and persevere in solving them MP.2. Reason abstractly and quantitatively MP.3.Construct viable arguments and critique the reasoning of others. MP.7.Look for and make use of structure. MP.8.Look for an express regularity in repeated reasoning.
February	Geometry – Circles G-C	**Understand and apply theorems about circles.** 1. Prove that all circles are similar. 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.* 3. Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a	• Prove all circles are similar • Identify/describe relationships (angles, radii, chords) • Construct inscribed/circumscribed circles • Prove properties of angles	MP.1. Make sense of problems and persevere in solving them MP.2. Reason abstractly and quantitatively MP.3.Construct viable arguments and critique the reasoning of others.

		circle.		MP.6.Attend to precision. MP.7.Look for and make use of structure. MP.8.Look for an express regularity in repeated reasoning.
March	Geometry – Congruence G-CO	**Make geometric constructions.** 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.* 13. Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.	• Geometric constructions • Use tools/technology to represent constructions • Construct regular polygons inscribed in a circle	MP.1. Make sense of problems and persevere in solving them MP.4. Model with mathematics. MP.5.Use appropriate tools strategically. MP.6.Attend to precision. MP.7.Look for and make use of structure.
April	Geometry – Expressing Geometric Properties with Equations G-GPE	**Translate between the geometric description and the equation for a conic section.** 1. 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. 2. Derive the equation of a parabola given a	• Derive equations • Apply Pythagorean Theorem • Complete square • Find center/radius • Derive parabolic equations • Use coordinates • Prove theorems • Prove slope criteria	MP.1. Make sense of problems and persevere in solving them MP.2. Reason abstractly and quantitatively

		focus and directrix. **Use coordinates to prove simple geometric theorems algebraically.** 4. Use coordinates to prove simple geometric theorems algebraically. *For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle; prove or disprove that the point (1, $\sqrt{3}$) lies on the circle centered at the origin and containing the point (0, 2).* 5. Prove the slope criteria for parallel and 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). 6. Find the point on a directed line segment between two given points that partitions the segment in a given ratio. 7. Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.	• Find points on a line segment • Compute perimeter/area of polygons	MP.3.Construct viable arguments and critique the reasoning of others. MP.6.Attend to precision. MP.7.Look for and make use of structure. MP.8.Look for an express regularity in repeated reasoning.
May – June	Geometry – Geometric Measurement and Dimension G-GMD	**Explain volume formulas and use them to solve problems.** 1. Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. *Use dissection arguments, Cavalieri's principle, and informal limit arguments.* 2. (+) Give an informal argument using Cavalieri's principle for the formulas for the volume of a sphere and other solid figures. 3. Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems. ★ **Visualize relationships between two-dimensional and three-dimensional objects.** 4. Identify the shapes of two-dimensional	• Give arguments for formulas • Apply Volume formulas • Cavalieri's principle • Volume of sphere/other solids • Identify 2-D/3-D shapes/cross sections/rotations	MP.1. Make sense of problems and persevere in solving them MP.2. Reason abstractly and quantitatively MP.3.Construct viable arguments and critique the reasoning of others. MP.6.Attend to precision.

		cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects		MP.7.Look for and make use of structure. MP.8.Look for an express regularity in repeated reasoning
	Geometry – Modeling with Geometry G-MG	**Apply geometric concepts in modeling situations.** 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). ★ 2. Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot). ★ 3. Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios). ★	• Use geometry to describe objects • Apply concept of density • Solve design problems	MP.1. Make sense of problems and persevere in solving them MP.2. Reason abstractly and quantitatively MP.4. Model with mathematics. MP.6.Attend to precision. MP.7.Look for and make use of structure.

Grade 11 Mathematics Curriculum Map-Algebra ll

Timeline/Teacher notes on progress	Topic	Standards	Content/Skills	Standards for Mathematical Practice
September – October	Numbers and Quantities - The Complex Number System N-CN	**Perform arithmetic operations with complex numbers.** 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. 2. Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers. **Use complex numbers in polynomial identities and equations.** 7. Solve quadratic equations with real coefficients that have complex solutions. 8. (+) Extend polynomial identities to the complex numbers. *For example, rewrite* $x^2 + 4$ *as* $(x + 2i)(x – 2i)$. 9. (+) Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials.	• Identify complex numbers • Use commutative, associative and distributive properties • Perform operations with complex numbers • Solve quadratic equations • Apply polynomial identities to complex numbers • Fundamental Theorem of Algebra	MP.1. Make sense of problems and persevere in solving them MP.2. Reason abstractly and quantitatively MP.6. Attend to precision MP.8.Look for an express regularity in repeated reasoning.
	Algebra – Seeing Structure in Expressions A-SSE	**Interpret the structure of expressions.** 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.* 2. Use the structure of an expression to identify ways to rewrite it. *For example, see* $x^4 – y^4$ *as* $(x^2)^2 – (y^2)^2$, *thus recognizing it as a difference of squares that can be factored as* $(x^2 – y^2)(x^2 + y^2)$.	• Interpret expressions • Rewrite expressions • Explain steps in solving equations • Derive formulas to solve problems	MP.1. Make sense of problems and persevere in solving them MP.2. Reason abstractly and quantitatively MP.6. Attend to Precision MP.7. Look for and make use of structure

		Write expressions in equivalent forms to solve problems. 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.* ★		
October - November	Algebra – Seeing Structure in Expressions A-APR	**Perform arithmetic operations on polynomials.** 1. Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials. MA.1.a. Divide polynomials. **Understand the relationship between zeros and factors of polynomials.** 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 $p(x)$. 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. **Use polynomial identities to solve problems.** 4. Prove polynomial identities and use them to describe numerical relationships. *For example, the polynomial identity* $(x^2 + y^2)^2 = (x^2 – y^2)^2 + (2xy)^2$ *can be used to generate Pythagorean triples.* 5. (+) Know and apply the Binomial Theorem for the expansion of $(x + y)^n$ in powers of x and y for a positive integer n, where x and y are any numbers, with coefficients determined for example by Pascal's Triangle. **Rewrite rational expressions.** 6. Rewrite simple rational expressions in different forms; write $\boldsymbol{a(x)/b(x)}$ in the form $q(x) + \boldsymbol{r(x)/b(x)}$, where $a(x)$, $b(x)$, $q(x)$, and $r(x)$	• Demonstrate understanding of polynomials • Operations • Apply the Remainder Theorem • Graph functions defined by polynomials • Prove polynomial identities • Describe numerical relationships • Apply the Binomial Theorem • Rewrite rational expressions • Properties of rational expressions	MP.1. Make sense of problems and persevere in solving them MP.2. Reason abstractly and quantitatively MP.6. Attend to Precision MP.8.Look for an express regularity in repeated reasoning.

		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. 7. (+) Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.		
December	Algebra – Creating Equations A-CED	**Create equations that describe numbers or relationships.** 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. 2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. ★ 3. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.* ★ 4. Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law V = IR to highlight resistance R.* ★	• Create equations with one variable • Solve inequalities • Create equations with two or more variables • Graph equations • Represent quantitative relationships • Constraints of equations/inequalities/systems of equations • Interpret solutions • Rearrange formulas to highlight quantities of interest	MP.1. Make sense of problems and persevere in solving them MP.2. Reason abstractly and quantitatively MP.4. Model with mathematics MP.6. Attend to Precision MP.7. Look for and make use of structure
	Algebra – Linear, Quadratic, and Exponential Models F-LE	**Construct and compare linear, quadratic, and exponential models and solve problems.** 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. ★	• Express logarithms • Use technology to evaluate results	MP.1. Make sense of problems and persevere in solving them MP.2. Reason

				abstractly and quantitatively MP.4. Model with mathematics MP.5.Use appropriate tools strategically. MP.6. Attend to Precision MP.7. Look for and make use of structure
January-February	Functions – Interpreting Functions F-IF	**Interpret functions that arise in applications in terms of the context.** 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.* 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 the positive integers would be an appropriate domain for the function.* ★ 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. ★	• Use function notation • Evaluate and interpret functions • Identify sequences as functions • Interpret graphs • Demonstrate key features of function relationships • Relate domains of functions to quantitative relationships • Calculate and interpret function rate of change • Graph linear, and quadratic functions, • Graph square/cube roots functions • Graph exponential and logarithmic functions • Graph trignometric functions • Write functions defined by	MP.1.Make sense of problems and persevere in solving them. MP.2.Reason abstractly and quantitatively. MP.4. Model with mathematics. MP.5.Use appropriate tools strategically. MP.6.Attend to precision.

		Analyze functions using different representations. 7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. ★ b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. ★ c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. ★ e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude. ★ 8. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. MA.8.c. Translate among different representations of functions and relations: graphs, equations, point sets, and tables. 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.*	expressions • Explain properties of functions • Factoring • Square • Interpret results • Represent comparisons in a variety of methods	
March	Numbers and Quantities - Vector and Matrix Quantities N-VM	**Represent and model with vector quantities.** 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., $\boldsymbol{v}$, $\lvert\boldsymbol{v}\rvert$, $\lvert\lvert\boldsymbol{v}\rvert\rvert$, v). 3. (+) Solve problems involving velocity and other quantities that can be represented by vectors. **Perform operations on matrices and use matrices in**	• Vector quantities: magnitude and direction • Line segment representation • Use appropriate symbols • Solve problems (velocity and other quantities) • Use matrices to present/manipulate data • Apply operations to matrices	MP.1.Make sense of problems and persevere in solving them. MP.2.Reason abstractly and quantitatively.

		applications. 6. (+) Use matrices to represent and manipulate data, e.g., to represent payoffs or incidence relationships in a network. 8. (+) Add, subtract, and multiply matrices of appropriate dimensions. 12. (+) Work with 2 × 2 matrices as transformations of the plane, and interpret the absolute value of the determinant in terms of area	• Transformation of plane • Interpret Absolute value (area)	MP.4. Model with mathematics. MP.5.Use appropriate tools strategically. MP.6.Attend to precision
	Algebra – Reasoning with Equations and Inequalities A-REI	**Understand solving equations as a process of reasoning and explain the reasoning.** 2. Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise. **Represent and solve equations and inequalities graphically.** 11. Explain why the *x*-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.★	• Solve radical/rational expressions • Give examples • Present other solutions • Graph equations and solutions • Make tables • Explain solutions • Use technology	MP.1.Make sense of problems and persevere in solving them. MP.3.Construct viable arguments and critique the reasoning of others. MP.4. Model with mathematics. MP.5.Use appropriate tools strategically. MP.6.Attend to precision.
April	Functions – Building functions F-BF	**Build a function that models a relationship between two quantities.** 1. Write a function that describes a relationship between two quantities. ★ 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*	• Write functions • Determine expressions, processes or steps for calculation • Combine function types • Use operations • Write sequences • Model situations	MP.1.Make sense of problems and persevere in solving them. MP.2.Reason abstractly and quantitatively.

		to a decaying exponential, and relate these functions to the model. ★ **Build new functions from existing functions.** 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.* 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, $f(x) = 2x^3$ or $f(x) = (x + 1)/(x – 1)$ for $x \neq 1$.*	• Translate • Identify, on a graph, the effects of replacing value • Find values • Experiment with different cases • Use technology to illustrate explanations • Inverse functions • Solve equations • Write expressions	MP.4. Model with mathematics. MP.5.Use appropriate tools strategically. MP.6.Attend to precision MP.7.Look for and make use of structure. MP.8.Look for an express regularity in repeated reasoning. .
May	Functions – Trigonometric Functions F-TF	**Extend the domain of trigonometric functions using the unit circle.** 1. Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle. 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. **Model periodic phenomena with trigonometric functions.** 5. Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline. **Prove and apply trigonometric identities.** 8. Prove the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$ and use it to find sin (θ), cos (θ), or tan	• Radian measures/arcs • Unit circles • Coordinate planes • Apply trigonomic functions • Prove/apply Pythagorean identities of trigonomic functions	MP.1.Make sense of problems and persevere in solving them. MP.2.Reason abstractly and quantitatively MP.6. Attend to precision MP.7.Look for and make use of structure. MP.8.Look for an express regularity in repeated reasoning.

		(θ) given sin (θ), cos (θ), or tan (θ) and the quadrant.		
June	Statistics and Probability - Interpreting Categorical and Quantitative Data S-ID	**Summarize, represent, and interpret data on a single count or measurement variable.** 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. ★	• Use technology • Use mean and standard deviation of data • Estimate percentages	MP.1.Make sense of problems and persevere in solving them. MP.2.Reason abstractly and quantitatively. MP.4. Model with mathematics. MP.5.Use appropriate tools strategically. MP.6.Attend to precision MP.7.Look for and make use of structure. MP.8.Look for an express regularity in repeated reasoning.
	Statistics and Probability - **Making Inferences and Justifying Conclusions S-IC**	**Understand and evaluate random processes underlying statistical experiments.** 1. Understand statistics as a process for making inferences to be made about population parameters based on a random sample from that population. ★ 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*	• Apply statistics to real life examples • Evaluate data/results • Explain purpose/differences of statistical tools/process • Estimate mean/proportion • Margin of error • Data comparison of random experiments	MP.1.Make sense of problems and persevere in solving them. MP.2.Reason abstractly and quantitatively. MP.3.Construct

		probability 0.5. Would a result of 5 tails in a row cause you to question the model? ★ **Make inferences and justify conclusions from sample surveys, experiments, and observational studies.** 3. Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each. ★ 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. ★ 5. Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant. ★ 6. Evaluate reports based on data. ★		viable arguments and critique the reasoning of others MP.4. Model with mathematics. MP.5.Use appropriate tools strategically. MP.6.Attend to precision MP.7.Look for and make use of structure. MP.8.Look for an express regularity in repeated reasoning.
	Statistics and Probability - Using Probability to Make Decisions **S-MD**	**Use probability to evaluate outcomes of decisions.** 6. (+) Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator). ⋆ 7. (+) Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).	• Probability • Analyze/Evaluate decisions	MP.1.Make sense of problems and persevere in solving them. MP.2.Reason abstractly and quantitatively. MP.3.Construct viable arguments and critique the reasoning of others MP.4. Model with mathematics.

				MP.5.Use appropriate tools strategically. MP.6.Attend to precision MP.7.Look for and make use of structure.

Grade 12 Mathematics Curriculum Map-Algebra l, Algebra ll and Geometry for Review**

Timeline/Teacher notes on progress	Topic	Standards	Content/Skills	Standards for Mathematical Practice
September – October	Number and Quantity – Quantities N-Q	**Reason quantitatively and use units to solve problems.** 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. ★ 2. Define appropriate quantities for the purpose of descriptive modeling. ★ 3. Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. ★ MA.3.a. Describe the effects of approximate error in measurement and rounding on measurements and on computed	• Choose/interpret units • Solve multistep problems • Choose/interpret scale • Create graphs/data displays • Define quantities • Identify limitations • Significant figures • Evaluate precision of mathematical tools	MP.1. Make sense of problems and persevere in solving them MP.2. Reason abstractly and quantitatively MP.3.Construct viable arguments and critique the reasoning of others MP.4. Model with

		values from measurements. Identify significant figures in recorded measures and computed values based on the context given and the precision of the tools used to measure. ★		mathematics. MP.5.Use appropriate tools strategically. MP.6. Attend to Precision
	Algebra – Seeing Structure in Expressions A-SSE	**Interpret the structure of expressions.** 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.*	• Interpret expressions	MP.1. Make sense of problems and persevere in solving them MP.2. Reason abstractly and quantitatively MP.6. Attend to Precision MP.7. Look for and make use of structure
October - November	Algebra – Creating equations A-CED	**Create equations that describe numbers or relationships.** 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. ★ 2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. ★ 3. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as	• Create equations with one variable • Solve inequalities • Create equations with two or more variables • Graph equations • Represent quantitative relationships • Constraints of equations/inequalities/systems of equations • Interpret solutions • Rearrange formulas to highlight quantities of	MP.1. Make sense of problems and persevere in solving them MP.2. Reason abstractly and quantitatively MP.4. Model with mathematics MP.6. Attend to Precision MP.7. Look for and

		viable or non-viable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.* ★ 4. Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law V = IR to highlight resistance R.* ★	interest	make use of structure
	Algebra – Reasoning with Equations and Inequalities A-REI	**Understand solving equations as a process of reasoning and explain the reasoning.** 1. Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method. **Solve equations and inequalities in one variable.** 3. Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters. **Solve systems of equations.** 5. Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions. 6. Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables	• Explain steps of loving equations • Solve systems of equations • Solve linear equations with one variable • Solve systems of equations with two variables • Approximate solutions • Solve linear equations graphically	MP.1. Make sense of problems and persevere in solving them MP.2. Reason abstractly and quantitatively MP.3.Construct viable arguments and critique the reasoning of others MP.4. Model with mathematics MP.5. Use appropriate tools strategically MP.7. Look for and make use of structure
December	Algebra – Reasoning with Equations and Inequalities A-REI	**Represent and solve equations and inequalities graphically.** 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).	• Graph equations and solutions • Make tables • Explain solutions • Use technology	MP.1.Make sense of problems and persevere in solving them. MP.4. Model with mathematics.

		11. Explain why the x-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions. 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.		MP.5.Use appropriate tools strategically. MP.6.Attend to precision.
January	Functions – Interpreting Functions F-IF	**Understand the concept of a function and use function notation.** 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 $y = f(x)$. 2. Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context. 3. Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. *For example, the Fibonacci sequence is defined recursively by $f(0) = f(1) = 1$, $f(n + 1) = f(n) + f(n – 1)$ for $n \geq 1$.* **Interpret functions that arise in applications in terms of the context.**	• Define functions • Use function notation • Evaluate and interpret functions • Identify sequences as functions • Interpret graphs • Demonstrate key features of function relationships • Relate domains of functions to quantitative relationships • Calculate and interpret function rate of change • Use function notation • Evaluate and interpret functions • Identify sequences as functions • Interpret graphs • Demonstrate key features of function relationships	MP.1.Make sense of problems and persevere in solving them. MP.2.Reason abstractly and quantitatively. MP.4. Model with mathematics. MP.5.Use appropriate tools strategically. MP.6.Attend to precision. MP.7.Look for and make use of structure.

		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.* ★ 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 the positive integers would be an appropriate domain for the function.* ★ 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. ★	• Relate domains of functions to quantitative relationships • Calculate and interpret function rate of change	MP.8.Look for an express regularity in repeated reasoning.
February	Functions – Interpreting Functions F-IF	**Analyze functions using different representations.** 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. ★ e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude. ★ 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.*	• Graph linear, and quadratic functions, • Graph square/cube roots functions • Graph exponential and logarithmic functions • Graph trigometric • Represent comparisons in a variety of methods	MP.1. Make sense of problems and persevere in solving them MP.2. Reason abstractly and quantitatively MP.4. Model with mathematics MP.5. Use appropriate tools strategically MP.7. Look for and make use of

				structure MP.8. Look for and express regularity in repeated reasoning
	Functions – Building Functions F-BF	**Build a function that models a relationship between two quantities.** 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.* ★ 2. Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms. ★ **Build new functions from existing functions.** 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.*	• Write functions • Determine expressions, processes or steps for calculation • Combine function types • Use operations • Write sequences • Model situations • Translate • Identify, on a graph, the effects of replacing value • Find values • Experiment with different cases • Use technology to illustrate explanations • Inverse functions • Solve equations • Write expressions	MP.1.Make sense of problems and persevere in solving them. MP.2.Reason abstractly and quantitatively. MP.4. Model with mathematics. MP.5.Use appropriate tools strategically. MP.6.Attend to precision MP.7.Look for and make use of structure. MP.8.Look for an express regularity in repeated reasoning.
March	Functions – Linear, Quadratic and Exponential Models F-LE	**Construct and compare linear, quadratic, and exponential models and solve problems.** 1. Distinguish between situations that can be modeled with linear functions and with exponential functions. ★	• Differentiate between linear and exponential functions • Prove differences in linear/exponential functions • Rate/unit • Percentage rate/uni	MP.1. Make sense of problems and persevere in solving them MP.2. Reason

		a. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals. ★ b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. ★ c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another. ★ 2. Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table). ★ 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. ★ **Interpret expressions for functions in terms of the situation they model.** 5. Interpret the parameters in a linear or exponential function in terms of a context. ★	• Construct linear/exponential functions • Observe/use graphs to differentiate between exponential/linear functions • Interpret functions in context	abstractly and quantitatively MP.4. Model with mathematics MP.5.Use appropriate tools strategically. MP.6. Attend to Precision MP.7. Look for and make use of structure
April	Geometry – Congruence G-CO	**Experiment with transformations in the plane.** 1. Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc. 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	• Define geometric terms • Represent, describe and compare transformations in the plane • Describe rotations/reflections of polygons • Develop definitions of geometric terms • Draw transformed figures	MP.1. Make sense of problems and persevere in solving them MP.2. Reason abstractly and quantitatively M. 4.Model with mathematics. MP.5.Use appropriate tools

		stretch). 3. Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself. 4. Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments. 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.		strategically. MP.6. Attend to Precision MP.7.Look for and make use of structure.
	Geometry – Congruence G-CO	**Understand congruence in terms of rigid motions.** 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. 7. Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent. 8. Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions.	• Apply geometric definitions • Predict effects of rigid motion • Determine congruence • Congruent triangles/angles • Explain criteria for congruence	MP.1. Make sense of problems and persevere in solving them MP.2. Reason abstractly and quantitatively MP.3.Construct viable arguments and critique the reasoning of others. MP.6. Attend to Precision MP.7.Look for and make use of structure.
May	Geometry – Congruence G-CO	**Make geometric constructions.** 12. Make formal geometric constructions with a variety of tools and methods (compass and	• Geometric constructions • Use tools/technology to represent constructions • Construct regular polygons	MP.1. Make sense of problems and persevere in solving them

		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.* 13. Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.	inscribed in a circle	MP.4. Model with mathematics. MP.5.Use appropriate tools strategically. MP.6.Attend to precision. MP.7.Look for and make use of structure.
	Geometry-Expressing Geometric Properties with Equations G-GPE	**Use coordinates to prove simple geometric theorems algebraically.** 4. Use coordinates to prove simple geometric theorems algebraically. *For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle; prove or disprove that the point (1, $\sqrt{3}$) lies on the circle centered at the origin and containing the point (0, 2).* 5. Prove the slope criteria for parallel and 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). 7. Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.	• Use coordinates • Prove theorems • Prove slope criteria • Compute perimeter/area of polygons	MP.1. Make sense of problems and persevere in solving them MP.2. Reason abstractly and quantitatively MP.3.Construct viable arguments and critique the reasoning of others. MP.6.Attend to precision. MP.7.Look for and make use of structure. MP.8.Look for an express regularity in repeated reasoning.

June	Statistics and Probability – Interpreting Categorical and Quantitative Data S-ID	**Summarize, represent, and interpret data on a single count or measurement variable.** 1. Represent data with plots on the real number line (dot plots, histograms, and box plots). ★ 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. ★ 3. Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers). ★ **Summarize, represent, and interpret data on two categorical and quantitative variables.** 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. 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. ★ c. Fit a linear function for a scatter plot that suggests a linear association. ★ **Interpret linear models.** 7. Interpret the slope (rate of change) and the intercept (constant term) of a linear model in	• Represent data • Use statistics to approximate • Compare center and spread • Use mean and standard deviation of data • Estimate percentages • Use tools/technology • Summarize data • Interpret data • Recognize associations/trends • Fit functions to data • Solve problems in context of data • Emphasize models • Assess fit of functions • Analyze residuals • Scatter plots • Interpret slope and intercept • Correlation vs. causation	MP.1.Make sense of problems and persevere in solving them. MP.2.Reason abstractly and quantitatively. MP.4. Model with mathematics. MP.5.Use appropriate tools strategically. MP.6.Attend to precision MP.7.Look for and make use of structure. MP.8.Look for an express regularity in repeated reasoning.

		the context of the data. ★ 8. Compute (using technology) and interpret the correlation coefficient of a linear fit. ★ 9. Distinguish between correlation and causation. ★		

** The Collaborative also offers courses on Consumer Finance as well as Consumer Math. This usually happens after students have passed MCAS