

Math-Kindergarten

Numbers and Operations	Algebra	Measurement	Geometry
<p>Meaning: Count objects forward 0-30. Read and write numbers 0-30. Count orally 0-100. Compare and order numbers 0-30. Compare and order sets using same as, more than, less than.</p>	<p>Patterns: Create, describe and extend simple geometric patterns. Create describe and extend simple number patterns.</p>	<p>Units and Systems of Measurement: Know / use vocabulary for parts of the day (morning, afternoon, evening, night). Know / use vocabulary for relative time (yesterday, today, tomorrow, next year).</p>	<p>Geometric Shape and Properties: Identify, sort and classify objects by attribute. Relate similar 3D objects inside and outside the classroom to their geometric name (e.g. ball/ sphere, box/cube, soup can/cylinder).</p>
<p>Notation: Write numbers 1-30.</p>		<p>Techniques for Measurement: Identify tools that measure time (clocks, calendars).</p>	
<p>Place Value: Count by 5's and 10's with objects to 100. Understand numbers 1-30 have 1,2 or 3 groups of 10's.</p>		<p>Working with Measurements (problem solving): Identify daily landmark times tot the nearest hour (e.g. school begins at 8:00, lunchtime at 11:00).</p>	
<p>Add and Subtract Numbers: Compose and decompose numbers (e.g. $5=4+1$) Record mathematical thinking by writing simple addition and subtraction sentences. Describe / draw combinations for totals to 10.</p>		<p>Compare length and weight of objects by using reference objects. Compare two or more objects by length, weight, and capacity; and to describe the relationship.</p>	

Math-Grade 1

Numbers and Operations	Algebra	Measurement
<p>Meaning: Count to 110 by 1's, 2's, 5's, and 10's, starting from any number in the sequence; count to 500 by 100's and 10's; use ordinals to identify position in a sequence, e.g. 1st, 2nd, 3rd. Read and write numbers to 110 and relate them to the quantities they represent.</p>	<p>Formulas, Expressions, Equations, Inequalities:</p>	<p>Units and Systems of Measurement:</p>
<p>Notation: Order numbers to 110; compare using phrases such as "same as", "more than", "greater than", "fewer than" use = symbol. Use < and > symbols to record the results of comparisons. Arrange small sets of numbers in increasing or decreasing order, e.g., write the following from smallest to largest: 21, 16, 35.</p>	<p>Understand the inverse relationship between addition and subtraction, e.g., subtraction "undoes" addition; If $3 + 5 = 8$, we know that $8 - 3 = 5$ and $8 - 5 = 3$; recognize that some problems involving combining, "taking away" or comparing can be solved by either operation.</p>	<p>Measure the lengths of objects in non-standard units, e.g., pencil lengths, shoe lengths, to the nearest whole unit.</p> <p>Compare measured lengths using the words shorter, shortest, longer, longest, taller, tallest, etc.</p> <p>Tell time on a twelve-hour clock face to the hour, half hour, and quarter hour.</p>
<p>Place Value: Identify one more than, one less than, 10 more than, and 10 less than any number up to 100. Understand that a number to the right of another number on the number line is bigger and that a number to the left is smaller. Understand that when comparing two-digit numbers, if one number has more tens, it is greater: if the amount of tens is the same in each number, then the number with more ones is greater. Compose and decompose numbers through 30, including using bundles of tens and units, e.g., recognize 24 as 2 tens and 4 ones, 10 and 10 and 4, 20 and 4, and 24 ones. Count backward by ones starting from any number between 1 and 100.</p>	<p>Apply knowledge of fact families to solve simple open sentences for addition and subtraction such as $? + 2 = 7$ and $10 - ? = 6$.</p>	<p>Identify the different denominations of coins and bills.</p> <p>Match one coin or bill of one denomination to an equivalent set of coins/bills of other denominations, e.g., 1 quarter = 2 dimes and 1 nickel.</p> <p>Tell the amount of money: in cents up to \$1, in dollars, up to \$100. Use the symbols \$ and ¢.</p>
<p>Add and Subtract Numbers: Model addition and subtraction for numbers through 20 for a given contextual situation using objects or pictures; explain in words; record using numbers and symbols; solve. Compare two or more sets in terms of the difference in number of elements. Apply knowledge of fact families to solve simple open sentences for addition and subtraction. Understand that when all but one of the three numbers in an addition or subtraction equation are known the unknown number can be found. Understand the inverse relationship between addition and subtraction "undoes" addition; if $3 + 5 = 8$, we know that $8 - 3 = 5$ and $8 - 5 = 3$; recognize that some problems involving combining, "taking away", or comparing can be solved by either operation. List number facts (partners inside of numbers) for 2 through 10 e.g., $8 = 7 + 1 = 6 + 2 = 5 + 3 = 4 + 4$; $10 = 8 + 2 = 2 + 8$. Add three one-digit numbers.</p>		<p>Techniques for Measurement:</p> <p>Add and subtract money in dollars only or in cents only.</p> <p>Solve one-step word problems using addition and subtraction of length, money and time, including "how much more/less", without mixing units.</p>
<p>Fluency with Operations and Estimation: Know all the addition facts up to $10 + 10$, and solve the related subtraction problems fluently. Compute sums and differences through 30 using number facts and strategies, but no formal algorithm. Calculate mentally sums and differences involving a two-digit number and a one-digit number without regrouping; a two-digit number and a multiple of 10.</p>		

<p style="text-align: center;">Geometry</p>	<p style="text-align: center;">Data and Probability</p>
<p><i>Geometric Shapes, Properties and Mathematical Arguments:</i></p> <p>Create common two-dimensional and three-dimensional shapes, and describe their physical geometric attributes, such as color and shape.</p> <p>Decompose circles and rectangles into two and four equal parts. Describe the parts using the words halves, fourths and quarters, and using the phrases half of, fourth of, and quarter of.</p> <p>Describe a whole as two of, or four of the equal parts Understand that decomposing into more equal parts creates smaller parts.</p>	<p><i>Data Representation:</i></p> <p>Collect and organize data to use in pictographs.</p> <p>Make pictographs of given data using both horizontal and vertical forms of graphs; scale should be in units of one and include symbolic representation (e.g. J represents one child).</p> <p>Read and interpret pictographs.</p>
<p><i>Location and Spatial Relationships:</i></p> <p>Describe relative position of objects on a plane and in space, using words such as above, below, behind, in front of.</p>	
<p><i>Spatial Reasoning and Geometric Modeling:</i></p> <p>Create and describe patterns, such as repeating patterns and growing patterns using number, shape, and size.</p> <p>Distinguish between repeating and growing patterns.</p> <p>Predict the next element in a simple repeating pattern.</p> <p>Describe ways to get to the next element in simple repeating patterns.</p> <p>Identify a unit in a repeating pattern.</p>	

Numbers and Operations	Measurement
<p>Meaning: Count to 1000 by 1's, 10's, and 100's starting from any number in the sequence. Read and write numbers to 1000 in numerals and words and relate them to the quantities they represent. Compare and order numbers to 1000; use the symbols > and <. Express numbers through 999 using place values, e.g., 137 is 1 hundred, 3 tens, and 7 ones; use concrete materials. Count orally by 3's, and 4's starting with 0, and by 2's, 5's, and 10's starting from any whole number.</p>	<p>Units and Systems of Measurement:</p> <p>Measure lengths in meters, centimeters, inches, feet and yards approximating to the nearest whole unit and using abbreviations; cm, m, in, ft., yd. Measure area using non-standard units to the nearest whole unit. Using both A.M. and P.M. tell and write time from the clock face in five minute intervals and from digital clocks to the minute; include reading time: 9:15 as nine-fifteen and 9:50 as nine-fifty. Interpret time both as minutes after the hour and minutes before the next hour e.g. 8:50 as eight-fifty and ten to nine. Show times by drawing hands on a clock face. Use the concept of duration of time e.g. determine what time it will be half an hour from 10:15. Read and write amounts of money using decimal notation (e.g. \$1.15). Read temperature using the scale on a thermometer in degrees Fahrenheit.</p>
<p>Notation: Recognize name, and represent commonly used unit fractions with denominators 12 or less; model $\frac{1}{2}$, $\frac{1}{3}$ and $\frac{1}{4}$ by folding strips. Place 0 and halves, e.g. $\frac{1}{2}$, $1\frac{1}{2}$, $2\frac{1}{2}$ on the number line; relate to a ruler. Recognize that fractions such as $\frac{2}{2}$, $\frac{3}{3}$, and $\frac{4}{4}$ are equal to the whole (one). Recognize name and write commonly used fractions: $\frac{1}{2}$, $\frac{1}{3}$, $\frac{2}{3}$, $\frac{1}{4}$, $\frac{2}{4}$, $\frac{3}{4}$. For unit fractions from $\frac{1}{12}$ to $\frac{1}{2}$, understand the inverse relationship between the size of a unit fraction and the size of the denominator; compare unit fractions from $\frac{1}{12}$ to $\frac{1}{2}$.</p>	<p>Techniques for Measurement:</p> <p>Find the area of a rectangle with whole number side lengths by covering with unit squares and counting or by using a grid of unit squares; write the area as a product. Determine perimeters of rectangles and triangles by adding lengths of sides, recognizing the meaning of perimeter.</p>
<p>Place Value: Given a contextual situation that involves addition and subtraction using numbers through 99; model using objects or pictures; explain in words; record using numbers and symbols; solve. Find the distance between numbers on the number line. e.g., how far is 79 from 26? Find missing values in open sentences $42 + \underline{\quad} = 57$ use relationship between addition and subtraction. Understand multiplication as the result of counting the total number of objects in a set of equal groups 3×5 gives the number of objects in 3 groups of 5 objects, or $3 \times 5 = 5 + 5 + 5 = 15$. Represent multiplication using area and array models. Develop strategies for fluently multiplying numbers up to 5×5 Given a situation involving groups of equal size or of sharing equally, represent with objects, words, and symbols; solve. Understand division (+) as another way of expressing multiplication, using fact families with the 5×5 multiplication table; emphasize that division "undoes" multiplication $2 \times 3 = 6$ can be rewritten as $6 \div 3 = 2$.</p>	<p>Working with measurements (problem solving)</p> <p>Compare lengths; add and subtract lengths (no conversion of units). Add and subtract money in mixed units e.g. $\\$2.50 + 60$ cents and $\\$5.75 - \\3, but not $\\$2.50 + \\3.10. Solve simple word problems involving length and money.</p>
<p>Fluency with Operations and Estimation: Decompose 100 into addition pairs $99 + 1.98 + 2 \dots$ Add fluently two numbers through 99, using strategies including formal algorithms; subtract fluently two numbers through 99. Estimate the sum of two numbers with three digits. Calculate mentally the sums and differences involving three-digit numbers and ones; three-digit numbers and tens; three-digit numbers and hundreds.</p>	

Geometry	Data and Probability
<p>Geometric Shape and Properties:</p> <p>Identify, describe, and compare familiar two-dimensional shapes, such as triangles, rectangles, squares, circles, semi-circles, spheres, rectangular prisms. Explore and predict the results of putting together and taking apart two-dimensional and three-dimensional shapes.</p>	<p>Data Representation:</p> <p>Make pictographs using a scale representation using scales where symbols equal more than one.</p> <p>Read and interpret pictographs with scales, using scale factors of 2 and 3.</p> <p>Solve problems using information in pictographs; include scales such as each represents 2 apples</p>
<p>Mathematical Arguments:</p> <p>Determine perimeters of rectangles and triangles by adding lengths of sides, recognizing the meaning of perimeter. Distinguish between curves and straight lines and between curved surfaces and flat surfaces.</p>	
<p>Transformation and Symmetry:</p> <p>Recognize that shapes that have been slid, turned, or flipped are the same shape e.g., a square rotated 45 degrees is still a square.</p>	
<p>Spatial Reasoning and Geometric Modeling:</p> <p>Classify familiar plans and solid objects, e.g. square, rectangles, rhombus, cube, pyramid, prism, cone, cylinder, and sphere, by common attributes such as shape, size, color, roundness, or number of corners and explain which attributes are being used for classification.</p>	
<p>Location and Spatial Relationship:</p> <p>Find and name locations using simple coordinate systems such as maps and first quadrant grids.</p>	

Math-Grade 3

Numbers and Operations	Algebra
<p>Meaning: Compare and order numbers up to 10,000. Count orally by 6's, 7's, 8's and 9's starting with 0 making the connection between repeated addition and multiplication. Know that even numbers end in 0,2,4,6 or 8; name a whole number quantity that can be shared in two equal groups or grouped into pairs with no remainders; recognize even numbers as multiples of 2. Know that odd numbers end in 1,3,5,7 or 9 and work with patterns involving even and odd numbers. Understand that fractions may represent a portion of a whole unit that has been partitioned into parts of equal area or length; use the terms "numerator" and "denominator". Place fractions with denominator of 2,4, and 8 on the number line; relate the number line to a ruler; compare and order up to three fractions with denominators 2,4 and 8. Recognize name and use equivalent fractions with denominators 2,4, and 8 using strips as area models.</p>	<p>Patterns: Count orally by 6's ,7's, 8's and 9's starting with 0 making the connection between repeated addition and multiplication. Know that even numbers end in 2, 4, 6 or 8; name a whole number quantity that can be shared in two equal groups or groped into parts with no remainders; recognize even numbers as multiples of 2. Know that odd numbers end in 1,3,5,7 or 9 and work with patterns involving even and odd numbers.</p>
<p>Notation: Read and write numbers to 10,000 in both numerals and words and relate them to the quantities they represent, relate numeral or written word to a display of dots or objects. Understand and relate decimal fractions to fractional parts of a dollar ex $\frac{1}{2}$ dollar = \$0.50, $\frac{1}{4}$ dollar= \$0.25. Understand that any fraction can be written as a sum of unit fractions ex. $\frac{3}{4} = \frac{1}{4} + \frac{1}{4} + \frac{1}{4}$.</p>	<p>Relations: Use multiplication and division fact families to understand the inverse relationship of these two operations ex. Because $3 \times 8 = 24$ we know that $24 \div 8 = 3$ or $24 \div 3 = 8$; express a statement as an equivalent division statement. Find solutions to open sentences such as $7 \times \square = 42$ or $12 \div \square = 4$ using the inverse relationship between multiplication and division.</p>
<p>Place Value: Identify the place value of a digit in a number ex. In 3,241,the 2 is in the hundreds place. Recognize and use expanded notation for numbers using place value through 9,999 ex. 2,517 is $2,000+500+10+7$; 4 hundreds and 2 ones is 402.</p>	
<p>Add and Subtract Numbers: Find solutions to open sentences such as $7 \times \square = 42$ or $12 \div \square = 4$, using the inverse relationship between addition and subtraction. Use multiplication and division fact families to understand the inverse relationship of these two operations ex. Because $3 \times 8 = 24$ we know that $24 \div 3 = 8$ or $24 \div 8 = 3$; express a multiplication statement as an equivalent division statement. Recognize situations that can be solved using multiplication and division including finding "How many groups?" and "How many in a group?" and write mathematical statements to represent those situations. Solve division problems involving remainders viewing the remainder as the "number left over"; interpret based on problem context, ex when we have 25 children with 4 children per group then there are 6 groups with 1 child left over. Given problems that use any one of the four operations with appropriate numbers, represent with objects, words (including "product" and "quotient") and mathematical statements; solve. Recognize that addition and subtraction of fractions with equal denominators can be modeled by joining or taking away segments on the number line.</p>	

Math-Grade 3

Measurement	Geometry	Data and Probability
<p>Units and Systems of Measurement:</p> <p>Measure in mixed units within the same measurement system for length, weight, and time; feet and inches, meters and centimeters, kilograms and grams, pounds and ounces, liters and milliliters, hours and minutes, minutes and seconds, years and months.</p> <p>Understand relationship between sizes of standard units (e.g. feet and inches, meters and centimeters).</p> <p>Visualize and describe the relative sizes of one square inch and one square centimeter.</p> <p>Distinguish between units of length and area and choose a unit appropriate in the context.</p> <p>Know and use common units of measurement in length, weight and time.</p> <p>Know the definition of area and perimeter and calculate the perimeter of a square and rectangle given a whole number side lengths.</p> <p>Use square units in calculating area by converting the region and counting the number of the perimeter of a square and square units.</p> <p>Know benchmark temperatures such as freezing (32°F, 0°C); boiling (212°F, 100°C) and compare temperatures to these (e.g.. cooler, warmer).</p>	<p>Geometric Shape and Properties:</p> <p>Identify basic geometric shapes including isosceles, equilateral and right triangles and use their properties to solve problems.</p> <p>Identify parallel faces of rectangular prisms in familiar shapes and in the classroom.</p> <p>Identify, describe, build and classify familiar three dimensional solids ex. Cube, rectangular prism, sphere, pyramid, cone based on their component parts (faces, surfaces, bases, edges and vertices).</p> <p>Know the definition of area and perimeter of a square and rectangle given whole number side lengths.</p> <p>Identify points, line segments, lines and distance.</p> <p>Identify perpendicular lines and parallel lines in familiar shapes and in the classroom.</p> <p>Estimate the perimeter of a square and rectangle in inches and centimeters; estimate the area of a square and rectangle in square inches and square centimeters.</p>	<p>Data Representation:</p> <p>Read and interpret bar graphs in both horizontal and vertical forms.</p> <p>Read scales on the axes and identify the maximum, minimum and range of values in a bar graph.</p> <p>Solve problems using information in bar graphs, including comparison of bar graphs.</p>
<p>Techniques for Measurement:</p> <p>Estimate the perimeter of a square and rectangle in inches and centimeters.</p> <p>Estimate the area of a square and rectangle in square inches and square centimeters.</p>	<p>Mathematical Arguments:</p> <p>Distinguish between units of length and area and choose a unit appropriate in the context.</p>	
<p>Working with Measurements (problem solving):</p> <p>Add and subtract lengths, weights, and times using mixed units within the same measurement system.</p> <p>Add and subtract money in dollars and cents.</p> <p>Solve contextual problems about perimeters of rectangles and areas of rectangular regions.</p> <p>Solve applied problems involving money, length, and time.</p>	<p>Spatial Reasoning and Geometric Modeling:</p> <p>Compose and decompose triangles and rectangles to form other familiar two dimensional shapes (e.g. from a rectangle using two congruent right triangles or decompose a parallelogram into a rectangle and two right triangles).</p> <p>Represent front, top and side views of solids built with cubes.</p> <p>Use square units in calculating area by converting the number of square units.</p>	

Numbers and Operations

Meaning:

Read and write numbers to 1,000,000; relate them to the quantities they represent; compare and order.

Understand the magnitude of numbers up to 1,000,000; recognize the place values of numbers and the relationship of each place value to the place to its right, e.g., 1,000 is 10 hundreds.

Compose and decompose numbers using place value to 1,000,000's, e.g., 25,068 is 2 ten thousands, 5 thousands, 0 hundreds, 6 tens, and 8 ones.

List the first ten multiples of a given one-digit number; determine if a whole number is a multiple of a given one-digit whole number.

Find all factors of any whole number through 50, list factors pairs, and determine if a one-digit number is a factor of a given whole number.

Multiply two-digit numbers by 2, 3, 4, and 5 using the distributive property, e.g.,

$$21 \times 3 = (1 + 20) \times 3 = (1 \times 3) + (20 \times 3) = 3 + 60 = 63$$

Understand fractions as parts of a set of objects.

Locate tenths and hundredths on a number line.

Read and interpret decimals up to two decimal places; relate to money and place value decomposition.

Read, write, interpret, and compare decimals up to two decimal places.

Know that terminating decimals represent fractions whose denominators are 10, 10 x 10, 10 x 10 x 10, etc., e.g., powers of ten.

Know that fractions of the form m/n where m is greater than n , are greater than 1 and are called improper fractions; locate improper fractions on the number line.

Notation:

Know that some numbers, including 2, 3, 5, 7, and 11 have exactly two factors

(1 and the number itself) and are called prime numbers.

Use factors and multiples to compose and decompose whole numbers.

Use the relationship between multiplication and division to simplify

computations and check results.

Solve contextual problems involving whole number multiplication and division.

Place Value:

Write tenths and hundredths in decimal and fraction forms, and know the decimal equivalents for halves and fourths.

Explain why equivalent are equal, using models such as fraction strips or the number line for fractions with denominators of 12 or less, or equal to 100.

Locate fractions with denominators of 12 or less on the number line; include mixed numbers.

Understand the relationships among halves, fourths, and eighths and among thirds, sixths, and twelfths.

Write improper fractions as mixed numbers, and understand that a mixed number represents the number of "wholes" and the part of a whole remaining, e.g., $5/4 = 1 + 1/4 = 1 \frac{1}{4}$.

Compare and order up to three fractions with denominators 2, 4, and 8, and 3, 6, and 12, including improper fractions and mixed numbers.

Add and Subtract Numbers:

Add and subtract fractions less than 1 with denominators through 12 and/or 100, in cases where the denominators are equal or when one denominator is a multiple of the other, e.g., $1/12 = 5/12 = 6/12$; $1/6 + 5/12 = 7/12$; $3/10 - 23/100 = 7/100$.

Solve contextual problems involving sums and differences for fractions where one denominator is a multiple of the other (denominators 2 through 12, and 100).

Find the value of an unknown in equations such as $1/8 = x = 5/8$ or $3/4 - y = 1/2$.

Multiply fractions by whole numbers, using repeated addition and area or array models.

For problems that use addition and subtraction of decimals through hundredths, represent with mathematical statements and solve.

Add and subtract decimals through hundredths.

Fluency with Operations and Estimation:

Add and subtract whole numbers fluently.

Make appropriate estimations and calculations fluently with whole numbers using mental math strategies.

Multiply fluently any whole number by a one-digit number and a three-digit number by a two-digit number, for a two-digit by one-digit multiplication use distributive property to meaning for the algorithm.

Divide numbers up to four-digits by one-digit numbers and by 10.

Find the value of the unknowns in equations such as $a/10=25$; $125+b=25$

Estimate the answers to calculations involving addition, subtraction, or multiplication.

Know when approximation is appropriate and use it to check the reasonableness of answers; be familiar with common place-value errors in calculations.

Multiply and divide decimals up to two decimal places by a one-digit whole number where the result is a terminating decimal. e.g., $0.42 / 3 = .14$, but not $5 / 3 = 1.6$

Algebra	Measurement	Geometry	Data and Probability
<p>Patterns, Relations, Functions and Change:</p> <p>List the first ten multiples of a given one-digit whole number, determine if a whole number is a multiple of a given one-digit whole number.</p> <p>Find all factors of any whole number up to 50, list factor pairs, and determine if a one-digit number is a factor of a given whole number.</p> <p>Multiply two-digit numbers by 2,3,4 and 5 using the distributive property, e.g. $21 \times 3 = (1 + 20) \times 3 = (1 \times 3) + (20 \times 3) = 3 + 60 = 63$</p> <p>Find the value of the unknowns in equations such as $a + 10 = 25$; $125 + 6 = 25$</p>	<p>Units and Systems of Measurement:</p> <p>Measure using common tools and select appropriate units of measure.</p> <p>Measure and compare integer temperatures in degrees.</p> <p>Know and understand the formulas for perimeter and area of a square and a rectangle; calculate the perimeters and areas of these shapes and combinations of these shapes using the formulas.</p> <p>Find one dimension of a rectangle given the other dimension and its perimeter or area.</p> <p>Find the side of a square given its perimeter or area.</p> <p>Measure the surface area of cubes and rectangular prisms by covering and counting area of the faces.</p> <p>Identify right angle and compare angles to right angles.</p> <p>Carry out the following conversions from one unit of measure to a larger or smaller unit of measure: meters to centimeters, kilograms to grams, liters to milliliters, hours to minutes, minutes to seconds, years to months, weeks to days, feet to inches, ounces to pounds (using numbers that involve only simple calculations).</p> <p>Solve contextual problems about perimeter and area of squares and rectangles in compound shapes.</p> <p>Solve contextual problems about surface area.</p> <p>Give answers to a reasonable degree of precision in the context of a given problem.</p> <p>Techniques for Measurement:</p> <p>Understand and know how to used area formula of a triangle $A = 1/2bh$.</p> <p>Understand and know how to use area formula for a parallelogram $A = bh$.</p> <p>Build solids with unit cubes and state their volume.</p> <p>Working with Measurements (problem solving):</p> <p>Represent relationships between areas of rectangles, triangles and parallelograms using models.</p> <p>Solve problems about volume of rectangular prisms using multiplication and division of appropriate units.</p> <p>Formulas for Measurement:</p> <p>Know and use formulas for area of rectangles ($A = lw$), parallelograms ($A = bh$), squares ($A = ss$) and triangles ($A = 1/2bh$).</p> <p>Find volume of cube and rectangular prisms ($V = lwh$).</p>	<p>Geometric Shape and Properties:</p> <p>Identify basic geometric shapes, including isosceles, equilateral, and right triangles, and use their properties to solve problems.</p> <p>Measure surface area of cubes and rectangular prisms by covering and counting area of the faces.</p> <p>Identify right angles and compare angles to right angles.</p> <p>Identify and draw perpendicular, parallel, and intersecting lines using a ruler and a tool or object with a square (90 degree) corner.</p> <p>Know and understand the formulas for perimeter and area for a square and a rectangle, calculate the perimeters and areas of these shapes using the formulas.</p> <p>Find one dimension of a rectangle given the other dimension and its perimeter or area.</p> <p>Find the side of a square given its perimeter or area.</p> <p>Solve contextual problems about perimeter and area of squares and rectangles in compound shapes.</p> <p>Solve contextual problems about surface area.</p> <p>Identify and count the faces, edges, and vertices of basic three-dimensional geometric solids including cubes, rectangular prisms, and pyramids; describe the shape of their faces.</p> <p>Recognize plane figures that have line symmetry.</p> <p>Recognize rigid motion transformations (flips, sides, and turns) of a two-dimensional object.</p> <p>Transformation and Symmetry:</p> <p>Associate angle with certain amount of turning.</p> <p>Angles are measured in degrees</p> <p>$1/4$ turn = 90 degrees</p> <p>$1/2$ turn = 180</p> <p>$3/4$ turn = 270</p> <p>full turn = 360</p>	<p>Data Representation:</p> <p>Order a given set of data, find the median, and specify the range of values.</p> <p>Solve problems using data presented in tables and bar graphs. e.g., compare data represented in two bar graphs and read bar graphs showing two data sets.</p> <p>Data Interpretation:</p> <p>Interpret line graphs, solve problems based on line graphs.</p> <p>Data Analysis:</p> <p>Given a set of data, find and interpret the mean and mode.</p> <p>Solve multi-step problems involving mean.</p>

Numbers and Operations	Algebra	Measurement
<p>Meaning, Notation, Place Value and Comparisons: Understand percentages as parts out of 100, use % notation, and express a part of a whole as a percentage. Understand the relative magnitude of ones, tenths and hundredths and the relationship of each place value to the place to its right, e.g. one is 10 tenths, one tenth is 10 hundredths. Fractions are division statements $2 \div 3 = 2/3$ Find and create equivalent fractions, e.g., $1/2 = 4/8$. Find products of fractions with small denominators.</p>	<p>Patterns, Relations, Functions and Change: Express ratios in several ways given applied situations, e.g., 3 cups to 5 people, 3:5, 3/5; recognize and find equivalent ratios.</p>	<p>Units and Systems of Measurement: A=square units V=cubic units Compare liters, milliliters, cubic centimeters, cubic meters, cubic inches, cubic feet, cubic yards, and know abbreviations of all. Convert cubic centimeters to cubic meters/ cubic inches to cubic feet.</p>
<p>Number Relationships and Meaning for Operations: Understand the meaning of division of whole numbers with and without remainders; relate division to fractions and to repeated subtraction. Write mathematical statements involving division for given situations. Express fractions and decimals as percentages and vice versa. Solve contextual problems that involve finding sums and differences of fractions with unlike denominators using knowledge of equivalent fractions. Divide a fraction by a whole number and a whole number by a fraction, using simple unit fractions. Multiply a whole number by powers of 10: 0.01, 0.1, 1, 10, 100, 1000; and identify patterns. Multiply one-digit numbers by decimals up to two decimal places.</p>	<p>Formulas, Expressions, Equations, Inequalities: Relate division of whole numbers with remainders to the form $a = bq \div r$, e.g., $34 \div 5 = 6 \text{ r } 4$, so $5 \cdot 6 + 4 = 34$, note remainder (4) is less than the divisor (5). Find prime factorization of #'s 2-50, express in exponential notation, e.g., $24 = 2^3 \times 3$, and understand that every whole number greater than 1 is either prime or can be expressed as a product of primes. Solve for the unknowns in equations such as $1/4 + x = 7/12$.</p>	<p>Techniques for Measurement: Understand and know how to use area formula of a triangle $A = 1/2bh$ Understand and know how to use area formula for a parallelogram $A = bh$ Build solid with unit cubes and state their volumes.</p>
<p>Fluency with Operations and Estimation: Divide numbers by 10's, 100's, 1000's using mental strategies. Find products fluently up to 12×12; find related quotients using multiplication and division relationships. Multiply a multi-digit number by a two-digit number; recognize and be able to explain common computational errors such as not accounting for place value. Divide fluently up to a four-digit number by a two-digit number. Express the results of a division statement using the standard algorithm (e.g. $145 = 11 \times 13 + 2$ or $120 \div 7 = 17 \text{ } 1/7$) Solve applied problems involving multiplication and division of whole numbers. Add and subtract fractions with unlike denominators through 12 and/or 100, using the common denominator that is the product of the denominators of the 2 fractions, e.g., $3/8 + 7/10$: use 80 as the common denominator. Use mathematical statements to represent an applied situation involving addition and subtraction of fractions. Solve applied problems involving fractions and decimals; include rounding of answers and checking reasonableness.</p>		<p>Working with Measurements (problem solving): Represent relationships between areas of rectangles, triangles, and parallelograms using models. Solve problems about volume of rectangular prisms using multiplication and division of appropriate units.</p>

Geometry	Data and Probability
<p>Geometric Shapes, Properties and Mathematical Arguments:</p> <p>Find unknown angles in problems involving angles on a straight line, angles surrounding a point, and vertical angles. Measure angles with a protractor and classify them as acute, right, obtuse, or straight. Identify and name angles on a straight line and vertical angles. Know that angles on a straight line add up to 180° and angles surrounding a point add up to 360°; justify informally by “surrounding” a point with angles. Find unknown angles and sides using the properties of: triangles, including right, isosceles, equilateral; parallelograms, including rectangles and rhombuses; and trapezoids. Understand why the sum of the interior angles of a triangle is 180° and the sum of the interior angles of a quadrilateral is 360°, and use these properties to solve problems.</p>	<p>Data Representation:</p> <p>Construct line graphs from tables of data; include axis labels and scale. Read and interpret line graphs, e.g., distance – time graphs, and problems with two or three line graphs on same axes, comparing different data.</p>
<p>Spatial Reasoning and Geometric Modeling:</p> <p>Build solids with unit cubes and state their volumes.</p>	<p>Analyzing Data:</p> <p>Given a set of data, find and interpret the mean (using the concept of fair share) and mode. Solve multi-step problems involving</p>
<p>Transformation and Symmetry:</p> <p>Associate an angle with a certain amount of turning; know that angles are measured in degrees; understand that 90°, 180°, 270°, and 360° are associated respectively, with $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$ and full turns.</p>	

Numbers and Operations

Meaning:

Order rational numbers and place them on the number line

Locate negative rational numbers (including integers) on the number line; know that numbers and their negatives add to 0 and are on opposite sides at equal distance from 0 on a number line

Understand that a fraction or a negative fraction is a quotient of two integers e.g., $-8/3$ is -8 divided by 3

Understand that rational numbers are quotients of integers (non-zero denominators) e.g., a rational number is either a fraction or a negative fraction.

Understand and use integer exponents, excluding powers of negative numbers; express numbers in scientific notation.

Understand that 0 is an integer that is neither negative nor positive.

Know that the absolute value of a number is the value of the number ignoring the sign; or is the distance of the number from 0.

Find equivalent ratios by scaling up or scaling down.

Understand integer subtraction as the inverse of integer addition. Understand integer division as the inverse of integer multiplication.

Notation:

Solve for the unknown in equations such as $\frac{1}{4} \div \blacksquare = 1$.

Understand division of fractions as the inverse of multiplication, e.g., if $4/5 \div 2/3 = \blacksquare$, then $2/3 \cdot \blacksquare = 4/5$, so $\blacksquare = 4/5 \cdot 3/2 = 12/10$

Solve contextual problems involving percentages such as sales taxes and tips.

Place Value:

Identify and round decimals to the ten-thousandths. (rounding rules, whole number place-value)

Read, write, compare numbers expressed as decimals. Understand that a digit in one place represents ten times what it represents in the place to the right.

Fluency with Operations and Estimation:

Multiply and divide any two fractions, including mixed numbers, fluently.

Add and multiply integers between -10 and 10; subtract and divide integers using the related facts. Use the number line and chip models for addition and subtraction.

Add, subtract, multiply, and divide positive rational numbers fluently.

Calculate part of a number given the percentage and the number.

Given an applied situation involving dividing fractions, write a mathematical statement to represent the situation.

For applied situations, estimate the answers to calculations involving operations with rational numbers.

Solve applied problems that use the four operations with appropriate decimal numbers.

Use estimation methods (rounding, front-end, clustering) to add, subtract, multiply, and divide positive rational numbers fluently.

Math-Grade 6

Algebra	Measurement	Geometry	Data and Probability
<p>Patterns: Solve applied problems involving rates, including speed, e.g., if a car is going 50 mph, how far will it go in $3\frac{1}{2}$ hours? Solve problems involving linear functions whose input values are integers; write the equation; graph the resulting ordered pairs of integers, e.g., given c chairs, the “leg function” is $4c$; if you have 5 chairs, how many legs?; if you have 12 legs, how many chairs do you have?</p>	<p>Units and Systems of Measurement: Convert between basic units of measurement within a single measurement system, e.g., square inches to square feet.</p>	<p>Geometric Shapes, Properties and Mathematical Arguments: Understand that for polygons, congruence means corresponding sides and angles have equal measurements. Understand and apply basic properties of lines, angles, and triangles, including: -triangle inequality -relationships of vertical angles, complementary angles, supplementary angles -congruence of corresponding and alternate interior angles when parallel lines are cut by a transversal, and that such congruencies imply parallel lines -locate interior and exterior angles of any triangle, and use the property that an exterior angle of a triangle is equal to the sum of the remote (opposite) interior angles</p>	<p>Data: Read and interpret line graphs, and solve problems based on line graphs, e.g., distance-time graphs, and problems with two or three line graphs on same axes, comparing different data. Construct line graphs from tables of data; include axis labels and scale. Given a set of data, find and interpret the mean (using concept of fair share), mode, median, and range. Solve multi-step problems involving means.</p>
<p>Representation: Plot ordered pairs of integers and use ordered pairs of integers to identify points in all four quadrants of the coordinate plane. Represent simple relationships between quantities using verbal descriptions, formulas or equations, tables, and graphs, e.g., perimeter-side relationship for a square, distance-time graphs, and conversions such as feet to inches. Understand that relationships between quantities can be suggested by graphs and tables.</p>	<p>Techniques for Measurement: Compute the area and perimeter of rectangles, parallelograms, triangles. Compute the circumference of a circle. Compute the volume and surface area of the cubes and rectangular prisms given the lengths of their sides, using formulas.</p>	<p>-know that the sum of the exterior angles of a convex polygon is 360°</p>	<p>Probability: Express probabilities as fractions, decimals or percentages between 0 and 1; know that 0 probability means an event will not occur and that probability 1 means an event will occur. Compute probabilities of events from simple experiments with equally likely outcomes, e.g., tossing dice, flipping coins, spinning spinners, by listing all possibilities and finding the fraction.</p>
<p>Formulas: Use letters, with units, to represent quantities in a variety of contexts, e.g., y lbs., k minutes, x cookies. Distinguish between an algebraic expression and an equation. Represent information given in words using algebraic expressions and equations. Use standard conventions for writing algebraic expressions, e.g., $2x + 1$ means “two times x, plus 1” and $2(x + 1)$ mean “two times the quantity of $(x+1)$” Simplify expressions of the first degree by combining like terms, and evaluate using specific values. Relate simple linear equations with integer coefficients, e.g., $3x = 8$ or $x = 5 = 10$, to particular contexts and solve. Understand that adding or subtracting the same number to both sides of the equation creates a new equation that has the same solution. Understand that multiplying or dividing both sides of an equation by the same non-zero number creates a new equation that has the same solution. Solve equations of the form $ax + 8 = 15$ by hand for positive integer coefficients less than 20, use calculators otherwise, and interpret the results.</p>	<p>Working with Measurements (problem solving): Draw patterns (of faces) for a cube and rectangular prism that, when cut, will cover the solid exactly (nets).</p>	<p>Spatial Reasoning and Geometric modeling: Use paper folding to perform basic geometric constructions of perpendicular lines, midpoints of line segments and angle bisectors; justify informally.</p>	
		<p>Transformation and Symmetry: Understand the basic rigid motions in the plane (reflections, rotations, translations), relate these to congruence, and apply them to solve problems. Understand and use simple compositions of basic rigid transformations, e.g., a translation followed by a reflection.</p>	

Math-Grade 7

Numbers and Operations	Algebra	Geometry	Data and Probability
<p>Understand and Solve Problems:</p> <ul style="list-style-type: none"> Ratios Calculate rates of change, including speed Convert ratio quantities between different systems of units Calculating unit rates Finding equivalent fractions Solve proportion problems Multistep percent problems (simple interest, tax, markups, markdowns, gratuities commissions, fees, percent error Percent of increase or decrease Real-world applications 	<p>Understand and Apply Relationships:</p> <ul style="list-style-type: none"> Coordinate plane and ordered pairs Linear relationships and functions Direct variation relationships Slope intercept form Real-world applications 	<p>Draw and Construct Geometric Objects:</p> <ul style="list-style-type: none"> Use a ruler to construct squares, rectangles, triangles, and parallelograms with specified dimensions 	<p>Data Representation and Interpretation:</p> <ul style="list-style-type: none"> Mean, median, mode and range Line plots Line graphs Bar graphs
<p>Fluency with Operations and Estimation:</p> <ul style="list-style-type: none"> Order of operations; exponents Absolute value Utilizing number integer number lines Multiply and divide whole numbers Equivalent fractions and mixed numbers and decimals Decimal computations Fraction computations Mixed number computations Percentages Convert a rational number to a decimal by long division Terminating and repeating decimals Solve problems involving operations with integers (add, subtract, multiply and divide) Add, subtract, multiply and divide positive and negative rational numbers Estimate rational numbers (results) Real-world applications 	<p>Properties:</p> <ul style="list-style-type: none"> Basic properties of real numbers (e.g. identities, inverses, commutativity, associativity, distributive) 	<p>Understand and Solving Related Problems:</p> <ul style="list-style-type: none"> Metric measurements Perimeter Area Angles Circles Similar polygons and figures Scale drawings Scale models Triangle similarity (AAA, SAS, SSS) Scale factors Two similar triangles with scale factor r, have similar areas by a factor of r^2 	
	<p>Formulas, Expressions, and Equations:</p> <ul style="list-style-type: none"> Numbers and patterns Evaluating variables and expressions Translating words into math One-Step Equations with whole numbers, decimals, integers and fractions Linear equations of the form $ax + b = c$ and $ax + b = cx + d$ Simplifying algebraic expressions of the first degree, and justify using properties of real numbers Solving for x and y intercepts (using $ax + b = 0$) Solve applied problems for directly proportional and linear situations Real-world applications 		

Math-Grade 8

Numbers and Operations	Algebra	Geometry	Data and Probability
<p>Meaning: Understand the meaning of... Square and cube roots; relationship to squares and cubes Zero and negative numbers (Integers, Decimals, & Fractions) Rational or irrational numbers Monomials</p>	<p>Algebra Concepts: Simplify numerical & algebraic expressions using the order of operations Understand and apply the distributive property to simplify algebraic expressions Solve one- & two-step equations with integers, decimals, & fractions Solve multi-step equations with variables on both sides of the equation Solve one-, two-, & multi-step inequalities Solve proportions to scale objects Apply the percent proportion to find value Calculate total price with discount and tax and apply to real-world problems Multiplying polynomials by polynomials</p>	<p>Geometric Shape and Properties: Understand the definition of a circle and compute area and circumference of circles Find the area and perimeter of complex figures by subdividing them Volume formulas for cylinders, cones, pyramids and spheres Surface area formulas for prisms, cones, spheres, pyramids and cylinders</p>	<p>Data Representation: Collect and display data -- stem-and-leaf plots -- circle graphs -- box-and-whisker plots -- bar graphs & histograms</p>
<p>Notation: Scientific notation with positive and negative exponents Express monomials in prime factorization</p>	<p>Patterns: Analyze sequences to find the next term Identify the common difference or common ratio for arithmetic or geometric sequences Compute the nth term of arithmetic and geometric sequences</p>	<p>Mathematical Arguments: Understand a proof of the Pythagorean Theorem Use the Pythagorean Theorem to solve triangles Use the distance and midpoint formulas to find the distance and midpoint between two coordinates</p>	<p>Data Interpretation: Measures of Central Tendencies (mean, median, mode) Identify misleading statistics</p>
<p>Number Relations / Meaning of Operations: Solve problems involving... Percent increase and percent decrease Compound interest Weighted averages Ratio units</p>	<p>Functions and Change: Identify and represent a variety of functions Solve quadratics by factoring to find the x-intercepts (roots) and graph quadratic functions to find the x-intercepts (roots) Factor simple quadratic expressions Solve applied problems involving quadratic functions</p>	<p>Location and Spatial Relationship: Apply properties of similar triangles for indirect measurement</p>	<p>Data Analysis: Interpret scatterplots to find lines of best fit and to identify correlation</p>
<p>Fluency with Operations and Estimation: Square and cube roots Add, subtract, multiply, & divide integers Multiplying and dividing monomials with positive & negative</p>	<p>Representation: Translate verbal sentences to equations Determine if a relation is a function (vertical line test) Function notation Solve system of equations by graphing and substitution Graph linear inequalities Solve systems of linear inequalities</p>	<p>Spatial Reasoning, Geometric Modeling, Transformation and Symmetry: Sketch orthogonal views of 3-D figures Understand and use the concept of dilation Understand reflective and rotational symmetry Apply transformational rules to create a tessellation</p>	<p>Probability: Relative frequency Fundamental Counting Principle Theoretical vs. experimental probability Independent and dependent events</p>
	<p>Formulas: Use functions (formulas) in problem context Apply the square of a sum or difference as well as difference of squares</p>		

Math— Algebra I—Grade 9

1 st Trimester: Linear Expressions and Equations		2nd Trimester: Non-Linear Expressions and Equations	
<p>Simplifying Expressions: Order of Operations PEMDAS Combining Like Terms Simplifying multi-step complex expressions Properties and rules of adding, subtracting, multiplying and dividing.</p>	<p>Word Problems w/o Exponents: Consecutive Integer Problems Perimeter Problems Cost Problems Mixture Problems D=r*t Problems Wind, Water, Current Problems</p>	<p>Polynomial Expressions: Addition and subtraction of polynomials Multiplying monomials Powers of monomials Multiplying polynomials FOIL Negative exponents and dividing monomials Scientific notations</p>	<p>Quadratic Equations and Functions: Quadratic equations The quadratic formula Methods of solving quadratic equations Linear and quadratic functions Graphing quadratic equations and functions</p>
<p>Solving Linear Equations and Inequalities: Solve one-step equations Solve multi-step equations Solve simple inequalities Graph inequalities on a number line Solve combined inequalities Abs. values with disjunctions and conjunctions</p>		<p>Factoring: Factoring integers and monomials out of polynomials Difference of squares Perfect squares Factoring trinomials into two binomials Grouping Multi-step factoring Solving using factoring</p>	
<p>Graphing Linear Equations and Inequalities: Into to 2-variable equations Slope: $m=\Delta y/\Delta x$ Equation of a line Standard form and $y=mx+b$ Parallel lines Finding the slope-intercept form of the equation of a line</p>		<p>Algebraic Fractions: Simplifying algebraic fractions Multiplying and dividing algebraic fractions Adding and subtracting algebraic fractions Proportions and percents Solving equations with algebraic fractions</p>	
<p>Solving Systems of Linear Equations and Inequalities: Graphing method Substitution method Addition/subtraction method Multiplication w/ addition/subtraction method Graphing systems of linear inequalities</p>		<p>Rational and Irrational Numbers: Rational and irrational square roots with variables Multiplying, dividing and simplifying radicals Adding and subtracting radicals Solving equations that involve radicals</p>	

Quantitative Literacy and Logic		Geometry and Trigonometry	
<p>Reasoning about Numbers, Systems and Quantitative Situations: Number Systems and Number Sense Importance of the irrational number square root 2 and 3 in basic right triangle Representations and relations Use, interpret, and calculate vectors representing magnitude and direction</p>	<p>Language and Laws of Logic: Know and use terms of basic logic Use connectives:</p> <ul style="list-style-type: none"> • Not • And • Or • If • Then 	<p>Figures and Their Properties: Lines and Angles; Basic Euclidean and Coordinate Geometry</p>	<p>Circles and Their Properties</p>
		<p>Triangles and Their Properties</p>	<p>Three-Dimensional Figures</p>
<p>Calculation, Algorithms, and Estimation: Measurement Units, Calculations, Scales Convert units of measurement with and between systems Explain how arithmetic operations on measurements affects units Carry units through calculations</p>	<p>Use the quantifiers in mathematical and everyday setting and know how to logically negate statements involving them:</p> <ul style="list-style-type: none"> • There exists • All <p>Write the converse, inverse, and contrapositive of an “If...,then...” statement.</p>	<p>Triangles and Trigonometry</p>	<p>Standard Relationships Between Figures: Relationships between Area and volume Relationships between 2 and 3 dimensional representations Congruence and Similarity</p>
		<p>Quadrilaterals and Their Properties</p>	<p>Transformation of Figures in a Plane: Distance Preserving transformations Define reflection, rotation, translation, and glide reflection Find isomer of two images</p>
<p>Mathematical Reasoning, Logic and Proof: Mathematical Reasoning Distinguish between inductive and deductive reasoning Differentiate between statistical arguments and logical arguments based on rules of logic</p>	<p>Proof:</p> <ul style="list-style-type: none"> • Know the basic structure for the proof of an “If..., then....” statement and that proving the contrapositive is equivalent. • Construct proofs by contradictions. Use counter examples when appropriate to disprove the statement. 	<p>Polygons and Their Properties</p>	<p>Shape-preserving Transformations: Know the definition of dilation and find the image of a figure under a given dilation Identify center and magnitude</p>
			<p>Define and Explain the Roles of: Axioms Definitions, theorems Counterexamples proofs</p>

Reasoning about Numbers, System and Quantitative Situations	Calculation, Algorithms and Estimation	Expressions, Equations and Inequalities
<p>Representations and Relationships:</p> <p>Use mathematical symbols to represent quantitative relationships and situations.</p>	<p>Calculation Using Real and Complex Numbers:</p> <p>Explain the exponential relationship between a number and its base 10 logarithm, and use it to relate rules of logarithm to those of exponents in expressions involving numbers. Add, subtract and multiply complex numbers; use conjugates to simplify quotients of complex numbers.</p>	<p>Construction, Interpretation and Manipulation of Expressions:</p> <p>Give verbal description of an expression that is presented in symbolic form, write an algebraic expression from a verbal description and evaluate expressions given values of the variables. Add, subtract, multiply, and simplify polynomials and rational expressions. Divide a polynomial by a monomial. Transform exponential and logarithmic expressions into equivalent forms using the properties of exponents and logarithms, including the inverse relationship between exponents and logarithms</p>
<p>Counting and Probabilistic Reasoning:</p> <p>Describe, explain, and apply various counting techniques; relate combinations to Pascal's triangle; know when to use each technique.</p>	<p>Sequences and Iteration:</p> <p>Find the nth term in arithmetic, geometric, or other simple sequences. Compute sums of finite arithmetic and geometric sequences. Use iterative processes in such examples as computing compound interest or applying approximation procedures.</p>	<p>Solutions of Equations and Inequalities:</p> <p>Associate a given equation with a function whose zeros are the solutions of the equation. Solve polynomial equations and equations involving rational expressions and justify steps in the solution. Solve exponential and logarithmic equations and justify steps in the solution. Solve an equation involving several variables (with numerical or letter coefficients) for a designated variable, and justify steps in the solution. Know common formulas and apply appropriately in contextual situations.</p>
	<p>Measurement Units, Calculations and Sales:</p> <p>Describe and interpret logarithmic relationships in such contexts as the Richter scale, the pH scale, or decibel measurements; solve applied problems.</p>	

<p style="text-align: center;">Functions Families of Functions</p>		<p style="text-align: center;">Figures and Their Properties</p>
<p>Definition, Representations and Attributes of Functions: Recognize whether a relationship (given in contextual, symbolic, tabular, or graphical form) is a function, and identify its domain and range. Read, interpret, and use function notation, and evaluate a function at a value in its domain. Represent function in symbols, graphs, tables, diagrams, or words, and translate among representations. Identify the zeros of a function, the intervals where values of a function are positive or negative, and describe the behavior of a function as x approaches positive or negative infinity, given the symbolic and graphical representations. Identify and interpret the key features of a function and form its graph or its formula (s).</p>	<p>Representations of Functions: Identify a function as a member of a family of functions based on its symbolic or graphical representation; recognize that different families of functions have different asymptotic behavior. Write the general symbolic forms that characterize each family of functions.</p>	<p>Conic Sections: Find an equation of a circle given its center and radius; given the equation of a circle, find its center and radius. Identify and distinguish among geometric representations of parabolas, circles, ellipses, and hyperbolas; describe their symmetries, and explain how they are related to cones. Graph ellipses and hyperbolas with axes and parallel to the x- and y-axes, given equations</p>
<p>Operations and Transformations with Functions: Combine functions by addition, subtraction, multiplication, and division. Apply given transformations to parent functions, and represent symbolically. Recognize whether a function (given in tabular or graphical form) has an inverse, and recognize simple inverse pairs.</p>	<p>Exponential and Logarithmic Functions: Interpret the symbolic forms and recognize the graphs of exponential and logarithmic functions. Apply properties of exponential and logarithmic functions.</p>	<p style="text-align: center;">Univariate Data Examining Distributions</p> <p>Producing and Interpreting Plots: Construct and interpret dot plots, histograms, relative frequency histograms, bar graphs, basic control charts, and box plots with appropriate labels and scales; determine types of data; compare data sets and interpret differences based of graphs and summary statistics.</p>
<p>Models of Real-World Situations Using Families of Functions: Identify the family of functions best suited for modeling a given real-world situation. Adapt the general symbolic form of a function to one that fits the specifications of a given situation by using the information to replace arbitrary constants with numbers. Using the adapted general symbolic form, draw reasonable conclusions about the situation being modeled</p>	<p>Rational Functions: Write the symbolic form and sketch the graph of simple rational functions. Analyze graphs of simple rational functions and understand the relationship between the zeros of the numerator and denominator, and the function's intercepts, asymptotes, and domain.</p>	<p>Measures of Center and Variation: Calculate and interpret measures of center including: mean, median, and mode; explain uses, advantages and disadvantages of each measure given a particular set of data and its context.</p>

Functions	Families of Functions		
<p>Functions: Know and use a definition of a function to decide if a given relation is a function. Perform algebraic operations (including compositions) on functions and apply transformations (translations, reflections, and re-calls). Write an expression for the composition of one given function with another and find the domain, range, and graph of the composite function. Recognize components when a function is composed of two or more elementary functions. Determine whether a function (given symbolically or graphically) has an inverse and express the inverse (symbolically, if the function is given symbolically, or graphically, if given graphically) if it exists. Know and interpret the function notation for inverses. Determine whether two given functions are inverses, using composition. Identify and describe discontinuities of a function (e.g., greatest integer function, $1/x$) and how these relate to the graph. Understand the concept of limit of a function as x approaches a number or infinity. Use the idea of limit to analyze a graph as it approaches an asymptote. Compute limits of simple functions (e.g., find the limit as x approaches 0 of $f(x) = 1/x$) informally. Explain how the rates of change of functions in different families (e.g., linear functions, exponential functions, etc.) differ, referring to graphical representations.</p>	<p>Exponential and Logarithmic Functions: Use the inverse relationship between exponential and logarithmic functions to solve equations and problems. Graph logarithmic functions. Graph translations and reflections of these functions. Compare the large-scale behavior of exponential and logarithmic functions with different bases and recognize that different growth rates are visible in the graphs of the functions Solve exponential and logarithmic equations when possible, (e.g. $5^x = 3^{x+1}$). For those that cannot be solved analytically, use graphical methods to find approximate solutions. Explain how the parameters of an exponential or logarithmic model relate to the data set or situation being modeled. Find an exponential or logarithmic function to model a given data set or situation. Solve problems involving exponential growth and decay.</p>	<p>Polynomial Functions: Given a polynomial function whose roots are known or can be calculated, find the intervals on which the function's values are positive and those where it is negative. Solve polynomial equations and inequalities of degree greater than or equal to three. Graph polynomial functions given in factored form using zeros and their multiplicities, testing the sign on intervals and analyzing the function's large-scale behavior. Know and apply fundamental facts about polynomials: the Remainder Theorem, the Factor Theorem, and the Fundamental Theorem of Algebra.</p>	<p>Trigonometric Functions: Define (using the unit circle), graph, and use all trigonometric functions of any angle. Convert between radian and degree measure. Calculate arc lengths in given circles. Graph transformations of the sine and cosine functions (involving changes in amplitude, period, midline, and phase) and explain the relationship between constants in the formula and transformed graph. Know basic properties of the inverse trigonometric functions $\sin^{-1}x$, $\cos^{-1}x$, $\tan^{-1}x$, including their domains and ranges. Recognize their graphs. Know the basic trigonometric identities for sine, cosine, and tangent (e.g., the Pythagorean identities, sum and difference formulas, co-functions relationships, double-angle and half-angle formulas). Solve trigonometric equations using basic identities and inverse trigonometric functions. Prove trigonometric identities and derive some of the basic ones (e.g., double-angle formula from sum and difference formulas, half-angle formula from double-angle formula, etc.). Find a sinusoidal function to model a given data set or situation and explain how the parameters of the model relate to the data set or situation.</p>
	<p>Quadratic Functions: Solve quadratic-type equations (e.g. $e^{2x-4} e^{x+4}=0$) by substitution. Apply quadratic functions and their graphs in the context of motion under gravity and simple optimization problems. Explain how the parameters of an exponential or logarithmic model relate to the data set or situation being modeled. Find a quadratic function to model a given data set or situation.</p>	<p>Rational Functions and Difference Quotients: Solve equations and inequalities involving rational functions. Graph rational functions given in factored form using zeros, identifying asymptotes, analyzing their behavior for large x values, and testing intervals. Given vertical and horizontal asymptotes, find an expression for a rational function with these features. Know and apply the definition and geometric interpretation of difference quotient. Simplify difference quotients and interpret difference quotients as rates of change and slopes of secant lines.</p>	

Vectors, Matrices and Systems of Equations	Sequences, Series and Mathematical Induction	Polar Coordinates, Parameterizations and Conic Sections
<p>Perform operations (addition, subtraction, and multiplication by scalars) on vectors in the plane. Solve applied problems using vectors.</p> <p>Know and apply the algebraic and geometric definitions of the dot product of vectors.</p> <p>Know the definitions of matrix addition and multiplication. Add, subtract, and multiply matrices. Multiply a vector by a matrix.</p> <p>Represent rotations of the plane as matrices and apply to find the equations of rotated conics.</p> <p>Define the inverse of a matrix and compute the inverse of two-by-two and three-by-three matrices when they exist.</p> <p>Explain the role of determinants in solving systems of linear equations using matrices and compute determinants of two-by-two and three-by-three matrices.</p> <p>Write systems of two and three linear equations in matrix form. Solve such systems using Gaussian elimination or inverse matrices.</p> <p>Represent and solve systems of inequalities in two variables and apply these methods in linear programming situations to solve problems.</p>	<p>Know, explain, and use sigma and factorial notation. Given an arithmetic, geometric, or recursively defined sequence, write an expression for the nth term when possible. Write a particular term of a sequence when given the nth term.</p> <p>Understand, explain, and use the formulas for the sums of finite arithmetic and geometric sequences.</p> <p>Compute the sums of infinite geometric series. Understand and apply the convergence criterion for geometric series.</p> <p>Understand and explain the principle of mathematical induction and prove statements using mathematical induction.</p> <p>Prove the binomial theorem using mathematical induction. Show its relationships to Pascal's triangle and to combinations. Use the binomial theorem to find terms in the expansion of a binomial to a power greater than 3.</p>	<p>Convert between polar and rectangular coordinates. Graph functions given in polar coordinates.</p> <p>Write complex numbers in polar form. Know and use De Moivre's Theorem.</p> <p>Evaluate parametric equations for given values of the parameter.</p> <p>Convert between parametric and rectangular forms of equations.</p> <p>Graph curves described by parametric equations and find parametric equations for a given graph.</p> <p>Use parametric equations in applied contexts (e.g., orbits and projectiles) to model situations and solve problems.</p> <p>Know, explain, and apply the locus definitions of parabolas, ellipses, and hyperbolas and recognize these conic sections in applied situations.</p> <p>Identify parabolas, ellipses, and hyperbolas from equations, write the equations in standard form, and sketch an appropriate graph of the conic section.</p> <p>Derive the equation for a conic section from given geometric information (e.g., find the equation of an ellipse given its two axes). Identify key characteristics (e.g. foci and asymptotes) of a conic section from its equation or graph.</p> <p>Identify conic sections whose equations are in polar or parametric form.</p>

Math– Calculus-Grade 12

1st Trimester: Limits, Derivatives and Applications of Derivatives	2nd Trimester: Integration, Applications of Integration	3rd Trimester: Advanced Calculus with Focus on AP Test
<p>Review Concepts: Linear, polynomial, radical, rational, trigonometric, logarithmic, and exponential function, and transformations of function. Symmetry, intercepts, and points of intersection.</p> <p>Limits: Students will be able to evaluate limits analytically, algebraically, and graphically. Students will demonstrate an understanding of continuity and one-sided limits as they apply to polynomial, radical, trigonometric, piecewise, and rational functions with asymptotes. Students will be able to evaluate limits that approach Infinite.</p>	<p>Integrals: Students will be able to demonstrate understanding of the anti-derivative idea through slope fields and indefinite integrals. Students will be able to find the area under a curve using Riemann Sums to approximate and definite integrals to find the exact area. Students will apply the Mean Value Theorem to find an average value of a function.</p>	<p>Complex Integration: Students will be able to solve more complex integrals using the following integration techniques.</p> <ul style="list-style-type: none"> • Tabular integration • Integration by parts • Trig integrals • Trig substitution • Partial fractions <p>Students will be able to solve more complex limit problems using L'Hopital's Theorem</p>
<p>Derivatives: Students will demonstrate the ability to find the derivative of a function based on the limit definition of a derivative. Students will be able to evaluate derivatives of functions using basic differentiation techniques as well as the Power, Product, Quotient, and Chain Rules for derivatives. Students will be able to perform derivatives of functions that are not given in their explicit form using the process of Implicit differentiation Students will perform differentiation of logarithmic, trigonometric, exponential, rational, radical, polynomial, and linear functions.</p>	<p>Integration Continued: Students will be able to take both indefinite and definite integrals of the following types of functions:</p> <ul style="list-style-type: none"> • Polynomials • Radicals • Rational • Trigonometric and inverse trigonometric • Logarithmic and exponential <p>Students will be able to perform integration by substitution problems of both definite and indefinite integrals. Students will use a problem solving method to approach all integrals.</p>	<p>AP Review: Students will do a variety of practice AP Calculus AB Tests. Student will do older copies of University of Michigan mid-terms and finals. Students will do a variety of questions from the D&S Marketing sample AP questions and practice exams.</p>
<p>Applying the Derivative: Students will be able to find and evaluate the absolute and relative extrema of a given function as well as any inflection points Students will be able to describe intervals where the function is increasing, decreasing, concave up, and concave down. Students will be able to perform curve sketching of functions.</p>	<p>Differential Equations: Students will be able to solve differential equations by using the technique of separation of variables. Students will be able to solve 2 variable differential equations that have differing variables on both sides of the equation. Students will be able to solve for both the general and particular solutions of a differential equation.</p>	<p>NOTE: All three trimesters students will demonstrate knowledge through tests and quizzes. Also take home tests will be given periodically throughout the year in order to check for more complex understanding of the material. Students are encouraged to work together and facilitate higher order thinking on these assessments.</p>
<p>Real World Applications of Derivatives: Students will be able to solve basic and complex word problems using derivatives with the following topics: Related rate problems Distance, velocity, acceleration problems Optimization problems</p>	<p>Applications of Integration: Students will be able to solve for the area between curves after finding the necessary region. Students will solve different volumes of revolution using the disk, washer, and shell method. Students will solve application problems of arc length and surface area, work, center of mass, and pressure.</p>	