Diocese of Jackson
Office of Education

Mathematics
Curriculum Standards

Diocese of Jackson
Curriculum Revision Committee

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Mission Statement of the Catholic Diocese of Jackson Office of Education

Mission

The mission of the Diocese of Jackson- Office of Catholic Education is to foster centers of learning that are rooted in Gospel values and Catholic teachings as we pursue academic excellence in a safe and caring environment.

Vision

Utilizing technology to collaborate and communicate clearly and consistently and reflective practice to guide future goals, we will enable students to become more service oriented, more globally aware through technological connections, and more academically prepared for a constantly changing world.

Our vision will be accomplished by

1. Providing opportunities for all students to model Gospel teachings
2. Utilizing data-driven decision making and alignment of curriculum, standards, etc. to meet the individual needs of students
3. Engaging in current methodology regarding the teaching and learning process to provide a transformative education

Values

1. Embody and model Gospel values- respect, love, dignity, truth, mercy, forgiveness, morality
2. Quality education with academic success
3. Christ-centered service to the community

Curriculum Revision Process

The curriculum standards of the Catholic Diocese of Jackson are the result of collaborative effort among teachers, administrators, and education professionals who have closely studied the previous standards of the Diocese of Jackson, current state and national standards in all subject areas, diocesan student performance on standardized tests, and current trends in performance and assessment in the realm of education. After thorough review of multiple source documents, the subject area committees began constructing a set of curriculum standards and objectives that are rigorous and challenging while also remaining developmentally appropriate for each grade level.

Source Documents Consulted

Within the curriculum revision process the following source documents were utilized in constructing the Diocese of Jackson Curriculum Standards for Mathematics:

1. Mississippi College and Career Readiness Standards for Mathematics
2. National Standards and Benchmarks for Effective Catholic Schools
3. ACT Aspire Performance Level Descriptors
4. Diocese of Jackson's Catechist Companion
5. Curriculum Standards of the Diocese of Owensboro, Kentucky

Catholic Identity Integration

Throughout the curriculum revision process, each committee held our schools' Catholic identity at the focal point of their work. Each committee looked for natural opportunities to integrate standards from the Diocese of Jackson's Catechist's Companion, the Catechism of the Catholic Church, and other religious education materials to outline concrete ways to help students connect the academic information they are learning with the spiritual growth and development. The connections were then written as academic standards within each subject, and these connections are noted throughout the curriculum standards document.

Domains

For each subject, the standards and objectives of the Diocese of Jackson are divided into domains, based on the Anchor Standards of the Mississippi College and Career Readiness Standards. These domains are consistent across grade levels to ensure vertical alignment within each subject.

Mathematics Domains:

1. Counting and Cardinality
2. Operations and Algebraic Thinking
3. Numbers and Operations in Base Ten
4. Numbers and Operations—Fractions
5. Measurement and Data
6. Ratios and Proportional Relationships
7. The Number System
8. Expressions & Equations
9. Geometry
10. Statistics and Probability
11. Functions
12. Numbers and Quantity
13. Algebra

**At the middle and high school levels domains become more specific and vary as courses become more specific to various types of mathematics (e.g., algebra, geometry, calculus, etc.).

Standards

Within each domain the curriculum is broken into overarching standards, that represent what a student should be able to do by the end of the year. These standards are broad and cannot be assessed with just one type of assessment. This knowledge is developed over multiple lessons and takes time to master.

Objectives

Each standard is broken into small objectives. These objectives represent what a student should be able to master within one lesson or unit of study. As the students master each individual objective, they will acquire the skills needed to master the overarching standard within the domain.

Counting & Cardinality

Domain

1. **The student will be able to know number names and the count sequence. Students will demonstrate mastery by:**
   - 1.1. Counting to 100 by ones, fives and tens
   - 1.2. Counting forward beginning from a given number sequence (instead of beginning at 1)
   - 1.3. Writing numbers 0 to 50
   - 1.4. Representing a number of objects with a written n

Standard

2. **The student will be able to count to tell the number of objects. Students will demonstrate mastery by:**
   - 2.1. Saying 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 (one-to-one correspondence)
   - 2.2. Understanding that the last number name said tells the number of objects counted
   - 2.3. Understanding that each successive number name refers to a quantity that is one larger

Objectives

Curriculum Revision Schedule

In order to ensure that our academic standards are current and relevant to the ever-changing field of education and work force preparation, the Diocese of Jackson has outlined a continuous review process for academic standards. Beginning with the complete revision of all subjects in 2019, a timeline was established to annually review the standards of one core subject each year. Each year a selected committee will conduct a review focused on student learning and achievement and make recommendations for changes or additions to the diocesan standards for a specific subjects.

Subject Area	**Standards Review and Revision**	**Approval by Office of Catholic Education & Principals**	**Implemented**
All	2018-2019 Completed by Spring of 2019	Spring of 2019	2019-2020 School Year
Mathematics	2021-2022 Completed by Spring of 2022	Spring of 2022	2022-2023 School Year
Science	2022-2023 Completed by Spring of 2023	Spring of 2023	2023-2024 School Year
English Language Arts	2023-2024 Completed by Spring of 2024	Spring of 2024	2024-2025 School Year
Social Studies	2024-2025 Completed by Spring of 2025	Spring of 2025	2025-2026 School Year
Mathematics	2025-2026 Completed by Spring of 2026	Spring of 2026	2026-2027 School Year

Pre-Kindergarten

*The following standards should be used for both Pre-K3 and Pre-K4 classes. Keeping in mind the developmental stages that students progress through at ages three and four, teachers should provide scaffolding and support as needed, particularly in Pre-K3 programs. Students in Pre-K3 are not expected to master the standards, but rather the standards are provided to ensure students are exposed to concepts to allow for success the following year in Pre-K4. Students should master the following standards by the end of their Pre-K4 academic year.

Counting & Cardinality
1. The student will be able to recite numbers 1-30 in the correct order. **2. The student will be able to recognize, name, and attempt writing numbers 0-20.** **3. The student will be able to recognize that a numeral is a symbol that represents a number of objects using developmentally appropriate pre-kindergarten manipulatives.** **4. The student will be able to use 1 to 1 correspondence to count concrete objects up to 20.** **5. The student will be able to use comparative language to compare objects in a set.**
Operations & Algebraic Thinking
1. The student will be able to experiment with adding and subtracting by using developmentally appropriate manipulatives. **2. The student will be able to duplicate and extend simple patterns using concrete objects.**
Measurement & Data
1. The student will be able to use appropriate vocabulary (small, big, short, tall) to describe measurable attributes of everyday objects. **2. The student will be able to compare two objects using attributes of length, weight, and size using standard and nonstandard units of measurements.** **3. The student will be able to count, sort, categorize, and classify objects.**
Geometry
1. The student will be able to correctly name shapes in the environment. **2. The student will be able to differentiate between two- dimensional and three-dimensional shapes.** **3. The student will be able to create and represent shapes using developmentally appropriate pre-kindergarten materials. (popsicle sticks, play dough, pattern blocks)** **4. The student will be able to create representation of common objects using shapes. (pattern blocks)**

Catholic Identity Integration in Mathematics
Pre-Kindergarten 3 & 4

Core Values of Classroom Behavior and Culture
1. Sharing manipulatives 2. Provide a safe environment 3. Giving generously
Integration of Scripture and Church Teaching
1. Counting the animals on Noah's Ark 2. The 7 days of Creation (Genesis 2-3) 3. David vs Goliath- small/ big 4. Learning numbers/Counting: 12 Disciples and 10 Commandments 5. Psalm 90:12
Historic Church Figures and Events
1. Johannes Widmann- came up with the + and – sign (1460-1498) 2. Leonardo Pisano Bigollo (1170-1250)- "Fiboacci" numeral system

Kindergarten

Counting & Cardinality

1. **The student will be able to know number names and the count sequence.**
   Students will demonstrate mastery by:
   - 1.1. Counting to 100 by ones, fives and tens
   - 1.2. Counting forward beginning from a given number within the known sequence (instead of beginning at 1)
   - 1.3. Writing numbers 0 to 50
   - 1.4. Representing a number of objects with a written numeral 0 to 50
2. **The student will be able to count to tell the number of objects.**
   Students will demonstrate mastery by:
   - 2.1. Saying 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 (one-to-one correspondence)
   - 2.2. Understanding that the last number name said tells the number of objects counted
   - 2.3. Understanding that each successive number name refers to a quantity that is one larger
   - 2.4. Answering "how many?" questions about as many as 20 things arranged in a line, rectangular array, or a circle, or as many as 10 things in a scattered configuration; given a number from 1-20, counting out that many objects
   - 2.5. Identifying whether the number of objects in one group is greater than, less than or equal to the number of objects in another group
   - 2.6. Comparing two numbers between 1 and 20 presented as written numerals
   - 2.7. Identifying, completing, and generating a repeated pattern

Operations & Algebraic Thinking

1. **The student will be able to understand addition as putting together or adding to, and subtractions as taking apart and taking from.**
   Students will demonstrate mastery by:
   - 1.1. Representing addition and subtraction, in which all parts and whole of the problem are within 10, with objects, finger, mental images, drawings, sounds, acting out situations, verbal explanations, expressions, or equations
   - 1.2. Solving addition and subtraction word problems within 10 involving situations of adding to, taking from, putting together and taking apart with unknowns in all positions by using objects or drawings to represent the problem
   - 1.3. Decomposing numbers less than or equal to 10 into pairs in more than one way (by using objects or drawings and record each decomposition by drawing or equation).
   - 1.4. Finding the number that make 10 when added to a given number
   - 1.5. Fluently adding and subtracting within 10

Numbers & Operations in Base Ten

1. **The student will be able to work with numbers 11-19 to gain foundations for place value.**
   Students will demonstrate mastery by:
   1.1 Composing and decomposing numbers from 11-19 into tens and ones (example: 18=10+8)

Measurement & Data

1. **The student will be able to describe and compare measurable attributes.**
   Students will demonstrate mastery by:
   1.1. Describing measurable attributes of objects, such as length or weight
   1.2. Describing several measurable attributes of a single object
   1.3. Directly comparing two objects with a measurable attribute in common, to see which object has "more of"/ "less of" the attribute and describe the difference
2. **The student will be able to classify and count the number of objects in a given category.**
   Students will demonstrate mastery by:
   2.1. Classifying objects into given categories
   2.2. Counting the numbers of objects in each category and sorting the categories by count

Geometry

1. **The student will be able to identify and describe two and three-dimensional squares, circles, triangles, rectangles, hexagons, cubes, cones, cylinders, and spheres.**
   Students will demonstrate mastery by:
   1.1. Describing objects in the environment using names of shapes and describe the relative positions of these objects using positional terms
   1.2. Correctly naming shapes regardless on their orientation or size
   1.3. Identifying shapes as two dimensional or three dimensional
2. **The student will be able to analyze, compare, and create shapes.**
   Students will demonstrate mastery by:
   2.1. Analyzing and comparing two and three- dimensional shapes, in different sizes and orientations, using informal language to describe their similarities, differences, parts and other attributes
   2.2. Modeling objects in the world by drawing two-dimensional shapes and building three-dimensional shapes
   2.3. Composing simple shapes to form larger shapes

Catholic Identity Integration in Mathematics
Kindergarten

Core Values of Classroom Behavior and Culture
1. Sharing manipulative 2. Provide a safe environment 3. Giving generously
Integration of Scripture and Church Teaching
1. Counting the animals on Noah's Ark 2. The 7 days of Creation (Genesis 2-3) 3. David vs Goliath- small/big 4. Learning numbers: 12 Disciples and 10 Commandments Psalm 90:12
Historic Church Figures and Events
1. Johannes Widmann- came up with the + and – sign (1460-1498) 2. Leonardo Pisano Bigollo (1170-1250)- "Fiboacci" numeral system

1st Grade

Counting & Cardinality

1. **The student will be able to count to 120.**
   Students will demonstrate mastery by:
   1.1. Counting to 120 from any given number
   1.2. Counting by 2's, 3's, 5's, 10's from any given number

Operations & Algebraic Thinking

1. **The student will be able to use whole numbers to solve problems.**
   Students will demonstrate mastery by:
   1.1. Using 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 (use objects, drawings, and equations with a symbol for the unknown number to represent the problem
   1.2. Solving word problems that call for addition of three whole numbers whose sum is less than or equal to 20 (using objects, drawings, and equations with a symbol for the unknown number to represent the problem)
   1.3. Applying properties of operations as strategies to add and subtract (commutative property of addition and associative property of addition)
   1.4. Demonstrating that subtraction as an unknown-addend problem
   1.5. Relating counting to addition and subtraction (by counting on 2 to add 2)
   1.6. Adding and subtracting with 20, demonstrating fluency within 20; using strategies such as counting on, making ten, decomposing a number leading to a ten, using the relationship between addition and subtraction or creating an equivalent
   1.7. Understanding the meaning of the equal sign and determining if equations involving addition and subtraction are true or false
   1.8. Determining the unknown whole number in an addition or subtraction equation relating three whole numbers

Numbers & Operations in Base Ten

1. **The student will be able identify place value to solve problems.**
   Students will demonstrate mastery by:
   1.1. Counting to 120, starting at any number less than 120
   1.2. Reading and writing numerals and representing a number of objects with a written numeral
   1.3. Understanding that 10 can be thought of as a bundle of ten ones—called a "ten"
   1.4. Understanding that the numbers from 11 to 19 are composed of a ten and one, two, three, four, five, six, seven, eight, or nine objects
   1.5. Understanding that the numbers 10,20,30,40,50,60,70,80,90 refer to one, three, four, five, six, seven, eight, or nine tens

2. **The student will be able to compare numbers using terms greater than, less than or equal to.**
   Students will demonstrate mastery by:
   2.1. Comparing two two-digit numbers based on meanings of the tens and ones digits, recording the results of comparisons with the symbols <,>,=
3. **The student will be able to use their knowledge of place value to solve problems.**
   Students will demonstrate mastery by:
   3.1. Adding 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 models, drawings or strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relating the strategy to a written method and explaining the reasonings used
   3.2. Understanding that sometimes in adding two-digit numbers, one adds tens and tens, ones and ones, and sometimes it is necessary to compose a ten
   3.3. Mentally finding 10 more or 10 less than the number, without having to count and explaining the reasoning used
   3.4. Subtracting multiples of 10 in the range 10-90 from multiples of 10 in the range 10-90, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relating the strategy to a written method and explain the reasoning used

Measurement & Data

1. **The student will be able to use a variety of measurement tools.**
   Students will demonstrate mastery by:
   1.1 Ordering three objects by length; comparing the lengths of two objects indirectly by using a third object
   1.2 Expressing the length of an object as a whole number of length units, by laying multiple copies of a shorter object end to end; understanding that the length measurement of an object is the number of same-size length units that span it with no gaps or overlaps
   1.3 Telling and writing time in hours and half-hours using analog and digital clocks
   1.4 Identifying hour hand, minute hand and numbers
   1.5 Identifying the days of the week, the number of days in a week, and the number of weeks in each month
2 **The student will be able to create and analyze data.**
   Students will demonstrate mastery by:
   2.1 Organizing, representing, and interpreting data with up to three categories; asking and answering 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
3 **The student will be able to count money.**
   Students will demonstrate mastery by:
   3.1 Identifying the value of all U.S. coins (penny, nickel, dime, quarter, half-dollar, and dollar coins) and using appropriate cent and dollar notation

3.2 Knowing the comparative values of all U.S. coins
3.3 Counting like U.S. coins up to the equivalent of a dollar
3.4 Finding the equivalent value for all greater value U.S. coins using like value smaller coins (5 pennies equal 1 nickel, etc.)

Geometry

1. **The student will be able demonstrate knowledge of shapes.**
   Students will demonstrate mastery by:
   1.1. Distinguishing between defining attributes (e.g. triangles are closed and three-sided) versus non-defining attributes; build and draw shapes to possess defining attributes
   1.2. Composing two-dimensional shapes or three-dimensional shapes to create a composite shape and compose new shapes from the composite shape
   1.3. Recognizing basic shape transformations (example flip, turn, slide)
2. **The student will be able to decompose shapes into fractions.**
   Students will demonstrate mastery by:
   2.1. Partitioning circles and rectangles into two and four equal shares, describing the shares using the words halves, fourths, and quarters, and using phrases half of, fourth of, and quarter of
   2.2. Describing the whole as two of, or four of the shares and understanding that decomposing the shares into more equal shares creates smaller shares.

Catholic Identity Integration in Mathematics
1st Grade

Core Values of Classroom Behavior and Culture
1. Sharing manipulatives 2. Provide a safe environment 3. Giving generously
Integration of Scripture and Church Teaching
1. Communitive property referenced in Luke 12:52 2. Counting by 2's for the animals on Noah's Ark 3. Peter breaking the net (John 21:11) - place value 4. Being good stewards with our money for God's Kingdom 5. Psalm 90:12
Historic Church Figures and Events
1. Johannes Widmann- came up with the + and – sign (1460-1498) 2. Francois Viete- father of modern algebra 3. Leonardo Pisano Bigollo (1170-1250)- "Fiboacci" numeral system

2nd Grade

Operations & Algebraic Thinking

1. **The student will be able to represent and solve problems involving addition and subtraction.**
   Students will demonstrate mastery by:
   1.1. Using 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 an unknown number to represent the problem)
2. **The student will be able to add and subtract within 20.**
   Students will demonstrate mastery by:
   2.1. Fluently adding and subtracting within 20 using mental strategies (by the end of grade 2, know from memory all sums of two one-digit numbers)
3. **The student will be able to work with equal groups of objects to gain foundations for multiplication.**
   Students will demonstrate mastery by:
   3.1. Determining whether a group of objects has an odd or even number of members (e.g., by pairing objects or counting by 2s; writing an equation to express an even number as a sum of two equal addends)
   3.2. Using addition to find the total number of objects arranged in rectangular arrays with up to 5 rows and up to 5 columns; writing an equation to express the total as a sum of equal addends
   3.3. Adding multiplication facts 0's, 1's, 2's, 5's, 10's

Numbers & Operations in Base Ten

1. **The student will be able to understand place value on a level appropriate for second grade.**
   Students will demonstrate mastery by:
   1.1. Understanding that the three digits of a three-digit number represent amounts of hundred, tens and ones
   1.2. Understanding that 100 can be thought of as a bundle of ten tens
   1.3. Understanding that the numbers 100,200,300,400,500,600,700,800,900 refer to one, two, three, four, five, six, seven, eight, or nine hundreds
   1.4. Counting within 1000; skip counting by 5s starting at any number ending in 5 or 0 and by 10s and 100s starting at any number
   1.5. Reading and writing numbers to 1000 using base-ten numerals, numbers names, and expanded form
   1.6. Comparing two three-digit numbers based on meanings of the hundreds, tens, and ones digits, using <,>, = symbols to record the results of comparisons

2. The student will be able to use their understanding of place value and properties to add or subtract.
Students will demonstrate mastery by:

2.1. Adding and subtracting 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
2.2. Understanding that in adding or subtracting three-digit numbers, one adds or subtracts hundreds and hundreds, tens and tens, ones and ones; sometimes it is necessary to compose or decompose tens or hundreds
2.3. Fluently adding and subtracting within 100 using strategies based on place value, properties of operations, and/or the relationships between addition and subtraction
2.4. Adding up to four two-digit numbers using strategies based on place value and properties of operations
2.5. Mentally adding 10 or 100 to a given number 100-900, and mentally subtracting 10 to 100 from a given number 100-900
2.6. Explaining why addition and subtraction strategies work, using place value and the properties of operations

Measurement & Data

1. The student will be able to measure and estimate lengths in standard units.
Students will demonstrate mastery by:

1.1. Measuring the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes
1.2. Measuring the length of an object twice, using length units of different lengths for the two measurements; describing how the two measurements relate to the size of the unit chosen
1.3. Estimating lengths using units of inches, feet, centimeters, and meters
1.4. Measuring to determine how much longer one object is than another, expressing the length difference in terms of a standard-length unit

Geometry

1. The student will be able to reason with shapes and their attributes.
Students will demonstrate mastery by:

1.1. Recognizing, identifying, and drawing shapes having specified attributes, such as a given number of angles or a given number of equal faces
1.2. Partitioning a rectangle into rows and columns of same-size squares and count to find the total number of them
1.3. Partitioning circles and rectangles into two, three, or four equal shares, describing the shares using the words halves, thirds, half of, a third of, etc., and describing the whole as two halves, three thirds, four fourths
1.4. Recognizing that equal shares of identical wholes need not have the same shape
1.5. Recognizing basic shape transformations (e.g., flip, turn, slide)

Catholic Identity Integration in Mathematics
2nd Grade

Core Values of Classroom Behavior and Culture
1. Sharing manipulatives 2. Provide a safe environment 3. Giving generously
Integration of Scripture and Church Teaching
1. Communitive property referenced in Luke 12:52 2. Peter breaking the net (John 21:11)- place value 3. Being good stewards with our money for God's Kingdom 4. Psalm 90:12
Historic Church Figures and Events
1. Johannes Widmann- came up with the + and – sign (1460-1498) 2. Francois Viete- father of modern algebra 3. Leonardo Pisano Bigollo (1170-1250)- "Fiboacci" numeral system

3rd Grade

Operations & Algebraic Thinking

1. **The student will be able to represent and solve problems involving multiplication and division within 100.**
   Students will demonstrate mastery of this standard by:
   1.1. Understanding that multiplication can be expressed as equal groups or repeated addition
   (5 groups of 7 objects = 35 total objects or 7+7+7+7+7 = 35)
   1.2. Understanding and solving sharing and grouping division
   1.3. Using multiplication and division within 100 to solve word problems in situations involving equal groups, arrays, and measurement quantities, (e.g., by using drawings and equations with a symbol for the unknown number to represent the problem)
   1.4. Determining the unknown whole number in a multiplication or division equation relating three whole numbers, with factors 0-10 (e.g., 8 × ? = 48, 5 = ? ÷ 3, 6 × 6 = ?)
   1.5. Explaining the correspondence between expressions and equations
2. **The student will be able to understand properties of multiplication and the relationship between multiplication and division.**
   Students will demonstrate mastery of this standard by:
   2.1. Applying the following properties: commutative, associative, and distributive and understanding that the closure property is that the product of any two whole numbers is always a whole number
   2.2. Demonstrating that a division problem can be given in the terms of a multiplication problem (the product divided by a factor is the other factor)
3. **The student will be able to solve problems involving the four operations and identify and explain patterns in arithmetic.**
   Students will demonstrate mastery of this standard by:
   3.1. Recalling their basic multiplication and division facts 1-12
   3.2. Solving two step word problems (using any of the 4 operations) using equations that have a letter standing in for the unknown quantity
   3.3. Assessing reasonableness of answers using estimation and mental math
   3.4. Identifying arithmetic patterns (including patterns in the addition table or multiplication table), and explaining them using properties of operations (e.g., observe that 4 times a number is always even, and explain why 4 times a number can be decomposed into two equal addends)

Numbers & Operations in Base Ten

1. **The student will be able to use place value understanding and properties of operations to perform multi-digit arithmetic.**
   Students will demonstrate mastery of this standard by:
   - 1.1. Understanding place value through hundred thousands
   - 1.2. Using place value to round to the nearest 10, 100, 1,000, 10,000, and 100,000
   - 1.3. Fluently adding and subtracting within 1,000 and whole dollar amounts (including across zeros) using the following strategies: algorithm based on place value, properties of operations, and the inverse relationship between addition and subtraction
   - 1.4. Multiplying one-digit whole numbers by multiples of 10 in the range10–90 (e.g., 9 × 80, 5 × 60) using strategies based on place value and properties of operations
   - 1.5. Using a number line to determine relative location of a number with respect to two benchmark numbers

Numbers & Operations with Fractions

1. **The students will develop understanding of fractions.**
   Students will demonstrate mastery of this standard by:
   - 1.1. Understanding that a fraction can be part of a whole or part of a set
   - 1.2. Recognizing the numerator and denominator
   - 1.3. Understanding and representing a fraction as a number on a number line
   - 1.4. Partitioning a number line in equal parts based on the denominator of the fraction (halves, fourths, thirds, sixths, eights, and tenths)
   - 1.5. Understanding that two fractions are equivalent if they are the same size, or the same point on a number line
   - 1.6. Recognizing that comparisons are only valid when the two fractions refer to the same whole
   - 1.7. Recognizing and generating equivalent fractions and explaining how they are equivalent using visual fraction models
   - 1.8. Expressing whole numbers as fractions, and recognizing 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)
   - 1.9. Comparing two fractions with the same numerator or the same denominator by reasoning about their size and recognizing that comparisons are valid only when the two fractions refer to the same whole
   - 1.10. Recording the results of comparisons with the symbols >, =, or <, and justifying the conclusions, e.g., by using a visual fraction model
   - 1.11. Identifying a fraction that can be used to represent a ratio described in a context or from a verbal description of a real-world situation (such as 7 out of 10 correct on your test = 7/10)

Measurement & Data

1. **The student will be able to solve problems involving measurement and estimation of intervals of time, length, liquid volumes, and masses of objects.**
   The student will demonstrate mastery of this standard by:
   1.1. Telling and writing time to the nearest minute and measure time intervals in minutes using an analog clock
   1.2. Solving word problems involving addition and subtraction of time intervals in minutes, e.g., by representing the problem on a number line diagram (elapsed time)
   1.3. Measuring and estimating liquid volume, and length and distance, and masses of objects using standard and metric system
   1.4. Choosing an appropriate unit of measure for a given situation
   1.5. Adding, subtracting, multiplying, or dividing 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)
   1.6. Representing and interpreting data
   1.7. Drawing a scaled graph and solve one and two step problems using the following graphs: picture graph and bar graph
   1.8. Measuring length with a ruler up to a fourth of an inch
   1.9. Showing measurement data by making a line plot, where the horizontal scale is marked off the appropriate units, whole numbers, halves, or quarters
2. **The student will be able to understand concepts of perimeter and area.**
   The student will demonstrate mastery of this standard by:
   2.1. Recognizing area as an attribute of a plane figure and understanding concepts of area measurement
   2.2. Calculating area by counting the unit squares (square cm, square m, square in, square ft, and improvised units)
   2.3. Relating area to the operations of multiplication and addition
   2.4. Finding the area of a rectangle using the formula area = length X width in real world problems with sides no greater than 10
   2.5. Finding 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.
   2.6. Recognizing area as additive
   2.7. Solving real world problems involving perimeters of polygons, including: finding the perimeter given side lengths, finding an unknown side length, and understanding that rectangles with the same perimeter can have different areas and rectangles with the same area can have different perimeters

Geometry

1. **The student will be able to reason with shapes and their attributes. Students will demonstrate mastery of this standard by:**
   - 1.1. Drawing types of lines such as parallel, perpendicular and intersecting
   - 1.2. Drawing the four types of angles such as acute, right, obtuse, and straight in relation to a square
   - 1.3. Understanding that shapes may share attributes that makes them part of larger categories
   - 1.4. Recognizing rhombuses, rectangles, and squares as examples of quadrilaterals, and draw examples of quadrilaterals that do not belong to any of these subcategories
   - 1.5. Partitioning shapes into parts with equal areas; expressing the area of each part as a unit fraction of the whole (e.g., partition a shape into 4 parts with equal area, and describe the area of each part as 1/4 of the area of the shape)
   - 1.6. Recognizing and describing attributes of three-dimensional shapes (sphere, cylinder, cone, rectangular prism, triangular prism, triangular pyramid, cube, pyramid)
   - 1.7. Recognizing that a symmetric shape can be partitioned into parts of the same shape and size

Catholic Identity Integration in Mathematics
3rd Grade

Core Values of Classroom Behavior and Culture
1. Provide a safe environment 2. Giving generously
Integration of Scripture and Church Teaching
1. Communitive property referenced in Luke 12:52 2. Jesus feeds 5,000 people (Matthew 14: 13-21) 3. Being good stewards with our money for God's Kingdom 4. Fractions: Genesis 47: 24-26, 34 5. Psalm 90:12 6. 2 Peter 3:8
Historic Church Figures and Events
1. Francois Viete- father of modern algebra 2. Johannes Widmann- came up with the + and – sign (1460-1498) 3. Leonardo Pisano Bigollo (1170-1250)- "Fiboacci" numeral system 4. Antoine Lavoisier (1743- 1794)- metric system (kg) 5. Pythagorus 6. Archimedes (287 B.C.- 212 B.C.)- exponential notation

4th Grade

Operations & Algebraic Thinking

1. **The student will be able to use the 4 operations with whole numbers to solve problems.**
   Students will demonstrate mastery by:
   1.1. Interpreting 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)
   1.2. Representing verbal statements of multiplicative comparisons as multiplication equations
   1.3. Multiplying or dividing to solve word problems involving multiplicative comparison (e.g., by using drawings and equations with a symbol for the unknown number to represent the problem, distinguishing multiplicative comparison from additive comparison)
   1.4. Solving 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
   1.5. Representing these problems using equations with a letter standing for the unknown quantity
   1.6. Assessing the reasonableness of answers using mental computation and estimation strategies including rounding
2. **The student will be able to gain familiarity with factors and multiples.**
   Students will demonstrate mastery by:
   2.1. Finding all factor pairs for a whole number in the range 1–100
   2.2. Recognizing that a whole number is a multiple of each of its factors
   2.3. Determining whether a given whole number in the range 1–100 is a multiple of a given one-digit number
   2.4. Determining whether a given whole number in the range 1–100 is prime or composite
   2.5. Solving problems involving prime numbers, factors, and multiples
3. **The student will be able to generate and analyze patterns.**
   Students will demonstrate mastery by:
   3.1. Generating a number or shape pattern that follows a given rule
   3.2. Identifying apparent features of the pattern that were not explicit in the rule itself

Numbers & Operations in Base Ten

1. **The students will be able to generalize place value understanding for multi-digit whole numbers up to 100,000,000.**
   Students will demonstrate mastery by:
   1.1. Recognizing that in a multi-digit whole number, a digit in one place represents ten times what it represents in the place to its right (e.g., recognize that 700 ÷ 70 = 10 by applying concepts of place value and division)

1.2. Reading and writing multi-digit whole numbers using base-ten numerals, number names, and expanded form (standard form, word form, and expanded form)
1.3. Comparing and ordering two multi-digit numbers based on meanings of the digits in each place, using >, =, and < symbols to record the results of comparisons
1.4. Using place value to round multi-digit whole numbers to any place up to 100,000,000

2. The student will be able to use place value understanding and properties of operations to perform multi-digit arithmetic.
Students will demonstrate mastery by:
2.1. Fluently adding and subtracting (including subtracting across zeros) multi-digit whole numbers using the standard algorithm
2.2. Multiplying a whole number of up to four digits by a one-digit whole number, and multiplying two two-digit numbers, using strategies based on place value and the properties of operations (identity, commutative, associative, and distributive; Illustrating and explaining the calculation by using equations, rectangular arrays, and/or area models)
2.3. Finding 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; illustrating and explaining the calculation by using equations, rectangular arrays, and/or area models

3. The student will be about to estimate to check the result of a calculation.

Numbers & Operations with Fractions

1. The student will be able to extend understanding of fraction equivalence and ordering.
Students will demonstrate mastery by:
1.1. Understanding that you cannot have a denominator of 0 because you cannot divide by 0
1.2. Recognizing and generating equivalent fractions by multiplying or diving the numerator and denominator by the same number
1.3. Comparing 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 ½)
1.4. Recognizing that comparisons are valid only when the two fractions refer to the same whole
1.5. Recording the results of comparisons with symbols >, =, or <, and justify the conclusions using a model

2. The student will be able to build Fractions from unit fractions by applying and extending previous understanding of operations of whole numbers.
Students will demonstrate mastery by:
2.1. Understanding addition and subtraction of fractions as joining and separating parts referring to the same whole

2.2. Decomposing a fraction into a sum of fractions with the same denominator in more than one way, recording each decomposition by an equation and justifying decompositions by using a fractional model
2.3. Adding and subtracting mixed numbers with like denominators
2.4. Solving word problems involving addition and subtraction of fractions referring to the same whole and having like denominators by using visual fraction models and equations to represent the problem
2.5. Applying and extending previous understandings of multiplication to multiply a fraction by a whole number
2.6. Understanding that a fraction a/b as a multiple of 1/b
2.7. Using 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)
2.8. Understanding a multiple of a/b as a multiple of 1/b and using this understanding to multiply a fraction by a whole number (e.g. use a visual fraction model to express 3 × (2/5) as 6 × (1/5), recognizing this product as 6/5 (In general, n x (a/b) = (n × a)/b.))
2.9. Solving word problems involving multiplication of a fraction by a whole number and using visual fraction models and equations to represent the problem

3. The student will be able to understand decimal notation for fractions and compare decimal fractions.
Students will demonstrate mastery by:

3.1. Expressing a fraction with denominator 10 as an equivalent fraction with denominator 100 and using this technique to add two fractions with respective denominators 10 and 100 (e.g. express 3/10 as 30/100, and add 3/10 + 4/100 = 34/100)
3.2. Using decimal notation for fractions with denominators 10 or 100 (e.g. rewriting 0.62 as 62/100; describing a length as 0.62 meters; locating 0.62 on a number line diagram)
3.3. Comparing two decimals to hundredths by reasoning about their size
3.4. Recognizing that comparisons are valid only when the two decimals refer to the same whole; recording the results of comparisons with the symbols >, =, or <, and justifying the conclusions

Measurement & Data

1. The student will be able to solve problems involving measurement and estimation of intervals of time, liquid volumes, and masses of objects.
Students will demonstrate mastery by:

1.1. Knowing relative sizes of measurement units within one system of units (e.g. km, m, cm, mm; kg, g, mg; lb, oz.; l, ml; hr, min, sec.)
1.2. Expressing measurements in a larger unit in terms of a smaller unit within a single system of measurement
1.3. Recording measurement equivalents in a two-column table
1.4. Using the four operations to solve word problems involving intervals of time, money, distances, liquid volumes, masses of objects including problems that involve simple fractions or decimals, and problems that

require expressing measurements given in a larger unit in terms of a smaller unit

1.5. Using diagrams such as number lines that feature a measurement scale represent measurement quantities

1.6. Applying the area and perimeter formulas for rectangles in real world and mathematical problems

2. The student will be able to represent and interpret data.
Students will demonstrate mastery by:

2.1. Making a line plot to display a data set of measurements in fractions of a unit (1/2, 1/4, 1/8)

2.2. Solving problems involving addition and subtraction of fractions by using information presented in line plots (e.g. from a line plot find and interpret the difference in length between the longest and shortest specimens in an insect collection.)

3. The student will be able to understand concepts of angles and measure angles.
Students will demonstrate mastery by:

3.1. Recognizing angles as geometric shapes that are formed wherever two rays share a common endpoint and understanding concepts of angle measurement

3.2. Measuring angles in whole-number degrees using a protractor and sketching angles of specified measure

3.3. Recognizing angle measure as additive

3.4. Solving addition and subtraction problems to find unknown angles on a diagram in real world and mathematical problems by using an equation with a symbol for the unknown angle measure

4. The student will be able to select and use the appropriate tool to solve problems. (ruler, protractor)

Geometry

1. The student will be able to draw and identify lines and angles and classify shapes by their lines and angles.
Students will demonstrate mastery by:

1.1. Drawing points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular, intersecting and parallel lines

1.2. Identifying these in two-dimensional figure

1.3. Classifying 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

1.4. Classifying and recognizing triangles according to their sides and angles (e.g., equilateral, isosceles, scalene and angles are acute, obtuse and right.)

1.5. Recognizing 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.

1.6. Identifying line-symmetric figures and drawing lines of symmetry

Catholic Identity Integration in Mathematics
4th Grade

Core Values of Classroom Behavior and Culture
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Integration of Scripture and Church Teaching
1. Communitive property referenced in Luke 12:52 2. Being good stewards with our money for God's Kingdom 3. Fractions: Genesis 47: 24-26, 34 4. Measuring the Arc of the Covenant, Noah's Ark, and the temples 5. Psalm 90:12 6. Proverbs 11:1, 16:11- weights/ balance compared to life
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1. Francois Viete- father of modern algebra 2. Johannes Widmann- came up with the + and – sign (1460-1498) 3. Leonardo Pisano Bigollo (1170-1250)- "Fiboacci" numeral system 4. Rene Descartes (1596- 1650)- coordinate system 5. Antoine Lavoisier (1743- 1794)- metric system (kg) 6. Pythagorus 7. Archimedes (287 B.C.- 212 B.C.)- exponential notation

5th Grade

Operations & Algebraic Thinking

1. **The student will be able to write and interpret numerical expressions.**
   The student will demonstrate mastery by:
   - 1.1. Using parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols
   - 1.2. Writing simple expressions that record calculations with numbers, and interpreting numerical expressions without evaluating them (e.g., express the calculation "add 8 and 7, then multiply by 2" as 2 × (8 + 7).)
   - 1.3. Recognizing that 3 × (18932 + 921) is three times as large as 18932 + 921, without having to calculate the indicated sum or product
   - 1.4. Making sense of real-world problems involving any of the four operations and writing an expression that reflects that given situation
2. **The student will be able to analyze patterns and relationships.**
   The student will demonstrate mastery by:
   - 2.1. Generating two numerical patterns using two given rules
   - 2.2. Identifying apparent relationships between corresponding terms
   - 2.3. Forming ordered pairs consisting of corresponding terms from the two patterns and graphing the ordered pairs on a coordinate plane (e.g., 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.)

Numbers & Operations in Base Ten

1. **The student will be able to understand place value system.**
   The student will demonstrate mastery by:
   - 1.1. Recognizing 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 (e.g., "In the number 3.33, the underlined digit represents 3/10, which is 10 times the amount represented by the digit to its right (3/100) and is 1/10 the amount represented by the digit to its left (3))
   - 1.2. Explaining 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
   - 1.3. Using whole-number exponents to denote powers of 10
   - 1.4. Reading, writing, and comparing decimals to thousandths
   - 1.5. Reading and writing 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)

1.6. Comparing two decimals to thousandths based on meanings of the digits in each place, using >, =, and < symbols to record the results of comparisons
1.7. Using place value to round decimals to any place
1.8. Fluently multiplying multi-digit whole numbers using the standard algorithm
1.9. Finding 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
1.10 Illustrating and explaining the calculation by using equations, rectangular arrays, and/or area models
1.11 Adding, subtracting, multiplying, and dividing decimals to hundredths, using concrete models (to include, but not limited to: base ten blocks, number line, decimal tiles, etc.) or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relating the strategy to a written method and explain the reasoning used

Numbers & Operations with Fractions

1. The student will be able to use equivalent fractions as a strategy to add and subtract fractions

The student will demonstrate mastery by:

1.1. Adding and subtracting 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 (E.g., 2/3 + 5/4 = 8/12 + 15/12 = 23/12.)
1.2. Solving word problems involving addition and subtraction of fractions referring to the same whole, including cases of unlike denominators by using fractional models and equations
1.3. Using benchmark fractions and number sense of fractions to estimate mentally and assess the reasonableness of answers

2. The student will be able to use equivalent fractions to multiply and divide fractions.

The student will demonstrate mastery by:

2.1. Interpreting a fraction as division of the numerator by the denominator (a/b = a ÷ b)
2.2. Solving word problems involving division of whole numbers leading to answers in the form of fractions or mixed numbers (e.g., by using visual fraction models or equations to represent the problem)
2.3. Applying and extending previous understandings of multiplication to multiply a fraction or whole number by a fraction
2.4. Finding the area of a rectangle with fractional side lengths by filing 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.

2.5. Multiplying fractional side lengths to find areas of rectangles, and represent fraction products as rectangular areas

2.6. Interpreting multiplication as scaling (resizing), by 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

2.7. Explaining why multiplying a given number by a fraction greater than 1 results in a product greater than the given number (recognizing multiplication by whole numbers greater than 1 as a familiar case); explaining why multiplying a given number by a fraction less than 1 results in a product smaller than the given number; and relating the principle of fraction equivalence a/b= (n×a)/(n×b) to the effect of multiplying a/b by 1

2.8. Solving real world problems involving multiplication of fractions and mixed numbers by using models and equations

2.9. Applying and extending previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions

2.10. Interpreting division of a unit fraction by a non-zero whole number and computing such quotients (e.g., 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.)

2.11. Interpreting division of a whole number by a unit fraction and computing such quotients (e.g., 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.)

2.12. Solving real world problems involving division of unit fractions by non-zero whole numbers and division of whole numbers by unit fractions using models (e.g., how much chocolate will each person get if 3 people share 1/2 lb of chocolate equally? How many 1/3-cup servings are in 2 cups of raisins?)

Measurement & Data

1. The student will be able to convert like measurement units within a given measurement system.

The student will demonstrate mastery by:

1.1. Converting among different-sized standard measurement units within a given measurement system (customary and metric) (e.g., convert 5 cm to 0.05 m), and using these conversions in solving multi-step, real world problems

2. The student will be able to represent and interpret data.

The student will demonstrate mastery by:

2.1. Making a line plot to display a data set of measurements in fractions of a unit (1/2, 1/4, 1/8)

2.2. Using operations on fractions for this grade to solve problems involving information presented in line plots. (e.g., 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)

3. The students will be able to understand concept of volume and relate to multiplication and addition.

The student will demonstrate mastery by:

3.1. Recognizing volume as an attribute of solid figures and understand concepts of volume measurement

3.2. Measuring volumes by counting unit cubes, using cubic cm, cubic in, cubic ft, and improvised units

3.3. Relating volume to the operations of multiplication and addition and solving real world and mathematical problems involving volume

3.4. Finding the volume of a right rectangular prism with whole-number side lengths by packing it with unit cubes and showing 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

3.5. Representing threefold whole-number products as volumes (e.g., to represent the associative property of multiplication)

3.6. Applying 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

3.7. Recognizing volume as additive

3.8. Finding 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

3.9. Making sense of an irregular rectangular prisms to find the side lengths and then uses a volume formula to find the volume of a shape

Geometry

1. The student will be able to classify two-dimensional figures into categories based on their properties.

The student will demonstrate mastery by:

1.1. Using 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.

1.2. Understanding 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).

1.3. Representing 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
1.4. Understanding that attributes belonging to a category of two-dimensional figures also belong to all subcategories of that category (e.g., all rectangles have four right angles and squares are rectangles, so all squares have four right angles)
1.5. Classifying two-dimensional figures in a hierarchy based on properties

Catholic Identity Integration in Mathematics
5th Grade

Core Values of Classroom Behavior and Culture
1. Provide a safe environment 2. Respect for others during mathematical arguments 3. Giving generously
Integration of Scripture and Church Teaching
1. Communitive property referenced in Luke 12:52 2. Being good stewards with our money for God's Kingdom 3. Fractions: Genesis 47: 24-26, 34 4. Measuring the Arc of the Covenant, Noah's Ark, and the temples 5. Psalm 90:12 6. Revelation 21:16- study of volume and area 7. Matthew 1:17 8. Proverbs 11:1, 16:11- weights and balance compared to life
Historic Church Figures and Events
1. Francois Viete- father of modern algebra 2. Johannes Widmann- came up with the + and – sign (1460- 1498) 3. Leonardo Pisano Bigollo (1170-1250)- "Fiboacci" numeral system 4. Gerolamo Cardano (1501-1576)- negative numbers 5. Rene Descartes (1596- 1650)- coordinate sytem 6. Antoine Lavoisier (1743- 1794)- metric system (kg) 7. Pythagorus 8. Archimedes (287 B.C.- 212 B.C.)- exponential notation

6th Grade

Ratios & Proportional Relationships

****Students may use a four-function calculator for computations when appropriate. This will be determined at the discretion of the teacher.**

1. **The student will be able to understand the concept of a ratio and use mathematical terminology to describe a ratio relationship between two quantities.**
   To demonstrate mastery, students will:
   1.1. Writing a ratio that describes a relationship between two quantities
   1.2. Using ratios to solve real-world and mathematical problems
   1.3. Comparing data from bar diagrams and frequency tables using ratios
   1.4. Using ratios to describe a simple set of data in different ways: girls to boys, boys to girls, boys to total, total to girls
2. **The student will be able to understand the concept of a unit rate (e.g a/b) associated with a ratio (e.g a:b with b≠0), and use mathematical terminology in the context of a ratio relationship.**
   To demonstrate mastery, students will:
   2.1. Converting a given ratio to a unit rate
   2.2. Comparing unit rates
   2.3. Using ratio and rate reasoning to solve real-world and mathematical problems
   2.4. Using a variety of tools: Tape diagrams, double number lines, or equations to demonstrate equivalent ratios
   2.5. Calculate and justify the best buy using unit price
3. **The student will be able to construct and use tables to compare ratios**
   To demonstrate mastery, students will:
   3.1. Making a table of equivalent ratios
   3.2. Using tables to compare ratios
   3.3. Finding missing values in tables
   3.4. Plotting values on the coordinate plane
   3.5. Determining that the steeper line represents the greater ratio
   3.6. Using ratios and rates to solve real-world and mathematical problems, such as increasing a recipe to serve more people
4. **The student will be able to solve unit rate problems.**
   To demonstrate mastery, students will:
   4.1. Calculating speed, if distance and time are known
   4.2. Calculating unit price, if total cost and quantity are known
   4.3. Finding and justifying the "best buy"
   4.4. Using ratios and rates to solve real-world and mathematical problems
5. **The student will be able to find a percent of a quantity.**
   To demonstrate mastery, students will:
   5.1. Writing a percent as a rate per one hundred

5.2. Finding a percent of a quantity
5.3. Solving problems involving finding the whole when given a part and the percent.
5.4. Using ratios and rates to solve real-world and mathematical problems
5.5. Using a visual representation to model percent

6. **The student will be able to use ratio reasoning to convert measurement units**
   To demonstrate mastery, students will:
   6.1. Using a ratio as a conversion factor when working with measurements of different units
   6.2. Using ratios and rates to solve real-world and mathematical problems
   6.3. Manipulating and transforming units appropriately when multiplying or dividing quantities

The Number System

1. **The student will be able to 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**.
   To demonstrate mastery, students will:
   1.1. Plotting, labeling, and identifying fractions on a number line
   1.2. Evaluating the reasonableness of a solution based on the benchmark fractions of 0, 1⁄2, and 1
   1.3. Performing +, -, and · with fractions, and with whole numbers and fractions (with like and unlike denominators)
   1.4. Making comparisons between fractions given in multiple representations
   1.5. Performing operations with mixed numbers
   1.6. Using a variety of visual fraction models (tape diagram, number line diagram, or area model)
   1.7. Demonstrating use of the standard algorithm to convert between fractions and decimals
2. **The student will be able to *fluently* divide multi-digit numbers using the standard algorithm.**
   To demonstrate mastery, students will:
   2.1. Dividing multi-digit numbers using the standard algorithm
   2.2. Checking quotients for reasonableness
3. **The student will be able to *fluently* add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation.**
   To demonstrate mastery, students will:
   3.1. Adding and subtracting multi-digit decimals using the standard algorithm
   3.2. Multiplying and dividing multi-digit decimals using the standard algorithm
   3.3. Using estimation to check answers for reasonableness
4. **The student will be able to find the greatest common factor and the least common multiple of two whole numbers and use the distributive property to**

express a sum of two whole numbers with a common factor.
To demonstrate mastery, students will:

4.1. Finding the greatest common factor of two whole numbers less than or equal to 100
4.2. Finding the least common multiple of two whole numbers less than or equal to 12
4.3. Using 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

5. **The student will be able to understand that positive and negative numbers are used together to describe quantities having opposite directions or values.**
To demonstrate mastery, students will:

5.1. Explaining the relationship between positive and negative numbers in real-world context: temperature, money, sea level, and electric charge
5.2. Explaining the meaning of zero in any real-world context

6. **The student will be able to understand a rational number as a point on the number line.**
To demonstrate mastery, students will:

6.1. Plotting a rational number as a point on the number line
6.2. Extending number lines as needed to display data
6.3. Extending coordinate axes learned in previous grades
6.4. Plotting ordered pairs that may include negative coordinates

7. **The student will be able to 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.**
To demonstrate mastery, students will:

7.1. Recognizing opposite signs of numbers as indicating locations on opposite sides of 0 on the number line
7.2. Finding the opposite of any number
7.3. Reading numbers accurately plotted on the number line.
7.4. Plotting numbers accurately on the number line

8. **The student will be able to understand signs of numbers in ordered pairs as indicating locations in quadrants of the coordinate plane.**
To demonstrate mastery, students will:

8.1. Using the signs of the coordinates to determine the location of an ordered pair in the coordinate plane
8.2. Plotting a point on a coordinate plane
8.3. Reading a point plotted on the coordinate plane
8.4. Recognizing that when two ordered pairs differ only by signs, the locations of the points are related by reflections across one or both axes

9. **The student will be able to find and position integers and other rational numbers on a horizontal or vertical number line diagram.**

To demonstrate mastery, students will:

9.1. Finding and position integers and other rational numbers on a horizontal or vertical number line

9.2. Finding and graphing pairs of integers and other rational numbers on a coordinate plane

10. The student will be able to understand ordering and absolute value of rational numbers.

To demonstrate mastery, students will:

10.1. Ordering rational numbers least to greatest or greatest to least

10.2. Find the absolute value of a rational number

11. The student will be able to interpret inequalities as statements about the relative position of two numbers on a number line diagram.

To demonstrate mastery, students will:

11.1. Describing the relative position of two numbers on a number line when given an inequality

11.2. Interpreting inequalities as statements about the relative position of two numbers on a number line diagram

12. The student will be able to write, interpret, and explain statements of order for rational numbers in real- world contexts.

To demonstrate mastery, students will:

12.1. Writing and interpreting inequalities in terms of a real- world situation

12.2. Explaining what the numbers in an inequality representing

13. The student will be able to 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.

To demonstrate mastery, students will:

13.1. Explaining absolute value

13.2. Relating absolute value to real-world situations such as sea level, temperature, and debt

14. The student will be able to distinguish comparisons of absolute value from statements about order.

14.1. Distinguishing comparisons of absolute value from statements about order

15. The student will be able to solve real-world and mathematical problems by graphing points in all four quadrants of the coordinate plane.

To demonstrate mastery, students will:

15.1. Solving real-world and mathematical problems by graphing points in all four quadrants of the coordinate plane

15.2. Using coordinates and absolute value to find the distance between points

16. The student will be able to apply and extend previous understanding of addition and subtraction to add and subtract integers.

To demonstrate mastery, students will:

16.1. Describing situations in which opposite quantities combine to make 0

16.2. Using a horizontal or vertical number line to add any combination of positive and/or negative numbers
16.3. Using a horizontal or vertical number line to subtract any combination of positive and/or negative numbers
16.4. Applying strategies to solve integers problems in a real- world context

17. The student will be able to 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. Interpret sums of integers by describing real-world contexts.

To demonstrate mastery, students will:

17.1. Using a horizontal or vertical number line to add *p* + *q*, regardless of whether either number is positive or negative
17.2. Using a horizontal or vertical number line to show that a number and its opposite have a sum of zero (additive inverse)
17.3. Interpreting sums of integers in real-world contexts

18. The student will be able to understand subtraction of integers as adding the additive inverse,
***p* – *q* = *p* + (-*q*).**

To demonstrate mastery, students will:

18.1. Using a horizontal or vertical number line to find *p* – *q*
18.2. Using a horizontal or vertical number line to find *p* + (-*q*)
18.3. **Showing that the distance between two integers on the number line is the absolute value of their difference**
18.4. Solving subtraction of integers without the context of a real- world situation

19. The student will be able to apply and extend previous understanding of addition and subtraction to add and subtract integers.

To demonstrate mastery, students will:

19.1. Applying properties of operations as strategies to add and subtract integers
19.2. Adding or subtracting integers with or without a number line
19.3. Adding or subtracting integers with or without a four-function calculator
19.4. Demonstrating understanding of adding and subtracting by recognizing equivalent expressions

Expressions & Equations

1. The student will be able to write and evaluate numerical expressions involving whole-number exponents.

To demonstrate mastery, students will:

1.1. Writing an expression using exponents to illustrate repeated multiplication
1.2. Multiplying fluently whole numbers and fractions

1.3. Evaluating expressions that consist of whole numbers, exponents, fractions and decimals
1.4. Using a four-function calculator to evaluate expressions

2. **The student will be able to write, read, and evaluate expressions in which letters stand for numbers.**
   To demonstrate mastery, students will:
   2.1. Reading accurately an algebraic expression containing variables and exponents (reading)
   2.2. Translating an expression from words to symbols (writing)
   2.3. Substituting in a value for the given variable and complete the calculations (evaluating)
   2.4. Adding, subtracting, multiplying, and dividing fluently with whole numbers, fractions, and decimals
   2.5. Applying order of operations
   2.6. Using a four-function calculator for computations
   2.7. Writing an expression when using whole numbers, fractions, and decimals
   2.8. Identifying accurately the parts of an expression

3. **The student will be able to evaluate expressions at specific values of their variables.**
   To demonstrate mastery, students will:
   3.1. Evaluating an expression for a given value
   3.2. Substituting values in formulas to solve real-world problems
   3.3. Appling order of operations with or without parentheses
   3.4. Evaluating expressions that arise from formulas; however, students are not required to manipulate the formulas
4. **The student will be able to apply the properties of operations to generate equivalent expressions.**
   To demonstrate mastery, students will:
   4.1. Generating two or more equivalent expressions using the properties
   4.2. Composing and decomposing expressions using the properties
5. **The student will be able to identify when two expressions are equivalent (i.e., when the two expressions name the same number regardless of which value is substituted into them).**
   To demonstrate mastery, students will:
   5.1. Determining whether two expressions are equivalent by using the same value to evaluate both expressions
   5.2. Identifying equivalent expressions
   5.3. Using properties of operations to justify that two expressions are equivalent
6. **The student will be able to 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?**
   To demonstrate mastery, students will:
   6.1. Utilizing substitution to decide if an equation or inequality is true

6.2. Solving an equation or inequality to find the value of the variable
6.3. Using a four-function calculator to solve equations and inequalities

7. **The student will be able to 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.**
   To demonstrate mastery, students will:
   7.1. Using variables to represent numbers to solve real-world problems
   7.2. Determining the function of the variable in a real-world or mathematical problem
   7.3. Writing expressions when solving real-world or mathematical problems
   7.4. Identifying the relationship of the variable in real-world or mathematical problems
8. **The student will be able to 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.**
   To demonstrate mastery, students will:
   8.1. Solving equations when the values for the variables are given
   8.2. Writing and solve equations that represent real-world problems
   8.3. Fluently adding, subtracting, multiplying, and dividing whole numbers, fractions, and decimals
   8.4. Evaluating reasonableness of solutions
9. **The student will be able to 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.**
   To demonstrate mastery, students will:
   9.1. Writing an inequality to represent constraints or conditions in a real-world or mathematical problem
   9.2. Graphing a solution set of an inequality on a number line
   9.3. Explaining what the solution set of an inequality represents
10. **The student will be able to use variables to represent two quantities in a real- world problem that change in relationship to one another (independent and dependent variables) and analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation.**
    To demonstrate mastery, students will:
    10.1. Analyzing tables and graphs to determine the dependent and independent variable
    10.2. Analyzing tables and graphs to determine the relationship between dependent and independent variables
    10.3. Writing an equation with variables that represent the relationship between the dependent and independent variables
    10.4. Creating a table of two variables that represent a real-world situation in which one quantity will change in relation to the other

10.5. Using data to plot points on the coordinate plane
10.6. Interpreting patterns in the table and graph and relate them back to the equation
10.7. Using a four-function calculator to determine either variable

Geometry

1. **The student will be able to find the area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes.**
   To demonstrate mastery, students will:
   1.1. Calculating area of triangles and quadrilaterals when given base and height
   1.2. Calculating base or height when given area
   1.3. Composing polygons from triangles
   1.4. Decomposing polygons into triangles
   1.5. Solving real-world and mathematical problems
   1.6. Using a four-function calculator to solve for area
2. **The student will be able to 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.**
   To demonstrate mastery, students will:
   2.1. Computing volume after packing a rectangular prism with unit cubes
   2.2. Appling formulas to solve problems with real-world contexts
   2.3. Calculating volume with and without a four-function calculator
   2.4. Evaluating reasonableness of the volume of a prism in regard to its length, width, and height
3. **The student will be able to 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.**
   To demonstrate mastery, students will:
   3.1. Drawing polygons in the coordinate plane given coordinates for the vertices
   3.2. Using coordinates to find the length of a side joining points with the same first coordinate or the same second coordinate
   3.3. Subtracting positive and negative numbers
   3.4. Finding the perimeter and area of polygons
   3.5. Solving real-world and mathematical problems
4. **The student will be able to represent three- dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures.**
   To demonstrate mastery, students will:

4.1. Matching nets with corresponding three- dimensional figures
4.2. Drawing nets when given the name of a three-dimensional figure
4.3. Calculating surface area with and without a four-function calculator
4.4. Evaluating reasonableness of the surface area considering the lengths and widths of the faces of the figure
4.5. Solving real-world and mathematical problems

Statistics & Probability

1. **The student will be able to recognize a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answers.**
   To demonstrate mastery, students will:
   1.1. Recognizing a statistical question
   1.2. Developing a question that can be used to collect statistical information
   1.3. Collecting data to demonstrate the variability of the answers to the question
2. **The student will be able to 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.**
   To demonstrate mastery, students will:
   2.1. Describing a distribution of data in terms of center, spread, and overall shape
   2.2. Constructing a box plot to show the distribution of a set of data
   2.3. Interpreting data from a box plot
   2.4. Comparing multiple distributions looking for similar centers, spreads, and overall shapes
3. **The student will be able to 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.**
   To demonstrate mastery, students will:
   3.1. Calculating measures of center (mean, median, and mode) of a set of numerical data
   3.2. Calculating measures of variation by calculating range, interquartile range, or mean absolute deviation of a set of numerical data
   3.3. **Cannot use a calculator** but must be able to use the standard algorithm for calculating
4. **The student will be able to display numerical data in plots on a number line.**
   To demonstrate mastery, students will:
   4.1. Organizing and displaying data as a line plot or dot plot
   4.2. Organizing and displaying data in a histogram
   4.3. Organizing and displaying data in a box plot
   4.4. Calculating extremes, range, median, and mean to be able to display data in a box plot
   4.5. Identifying a graphical representation that is representative of a given data set

5. The student will be able to summarize numerical data sets in relation to their context such as by:

5.1. Reporting the number of observations.

To demonstrate mastery, students will:

5.1.1. Using a four-function calculator for rapid calculation of measures of center or variability

5.1.2. Reporting number of observations

5.2. Describing the nature of the attribute under investigation, including how it was measured and its units of measurement.

To demonstrate mastery, students will:

5.2.1. Identifying the attribute being investigated

5.2.2. Identifying how the attribute was measured and by what units

6. The student will be able to summarize numerical data sets in relation to their context such as by:

6.1. Giving quantitative measures of center (median, and/or mean) and variability (interquartile range), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered.

To demonstrate mastery, students will:

6.1.1. Calculating measures of center: mean, median, and mode

6.1.2. Calculating measures of variability: range, interquartile range, and mean absolute deviation

6.1.3. Identifying clusters, gaps, extremes, and outliers in the data set.

6.1.4. Describing overall patterns and how those patterns relate to the context of the data

6.1.5. Describing any deviations from the overall pattern and how they relate to the context of the data

6.2. Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered.

To demonstrate mastery, students will:

6.2.1. Calculating measures of center

6.2.2. Calculating measures of variability

6.2.3. Drawing inferences about the shape of the distribution using measures of center and/or variability

6.2.4. Justifying the use of a particular measure of center or variability based on the shape of the data

Catholic Identity Integration in Mathematics
6th Grade

Core Values of Classroom Behavior and Culture
1. Provide a safe environment 2. Respect for others during mathematical arguments 3. Giving generously
Integration of Scripture and Church Teaching
1. Communitive property referenced in Luke 12:52 2. Being good stewards with our money for God's Kingdom 3. Fractions: Genesis 47: 24-26, 34 4. Measuring the Arc of the Covenant, Noah's Ark, and the temples 5. Psalm 90:12 6. Revelation 21:16- study of volume and area 7. Matthew 1:17 8. Proverbs 11:1, 16:11- weights and balance compared to life
Historic Church Figures and Events
1. Francois Viete- father of modern algebra 2. Johannes Widmann- came up with the + and – sign (1460- 1498) 3. Leonardo Pisano Bigollo (1170-1250)- "Fiboacci" numeral system 4. Gerolamo Cardano (1501-1576)- negative numbers 5. Rene Descartes (1596- 1650)- coordinate sytem 6. Antoine Lavoisier (1743- 1794)- metric system (kg) 7. Pythagorus 8. Archimedes (287 B.C.- 212 B.C.)- exponential notation

Suggested Courses of Study for Mathematics

Beginning in grade seven additional course options, such as honors or Advance Placement classes may be offered. The specific standards for honors or AP classes are determined at the local level, but all most meet and exceed curriculum standards and objectives in this document. Copies of the curriculum standards for ALL classes offered must be approved by the Office of Education, and a copy of approved standards must be kept on file at the school and the Office of Education.

Grade	Option1	Option 2	Option 3
7	Math 7	Compacted Math 7	Compacted Math 7
8	Math 8	Compacted Math 8 with Algebra I	Compacted Math 8 with Algebra I
9	Algebra I	Algebra II	Honors Algebra II
10	Algebra II	Geometry	Honors Geometry
11	Geometry	Trigonometry & Pre-Calculus	Honors Trigonometry & Pre-Calculus
12	Algebra III or Trigonometry & Pre-Calculus	Calculus or other advanced math	AP Calculus

Catholic Identity Integration in Middle and High School Mathematics Courses

As courses progress at the middle and high school levels, theology and religion classes become more departmentalized and offer a number of opportunities for integration with other subjects. The following are suggested opportunities for integration in the mathematics classroom. In addition to the opportunities listed below, teachers are expected to work cooperatively with religion and theology teachers in their schools to ensure that the strong spirit of our Catholic faith if woven into every academic class.

Core Values of Classroom Behavior and Culture
1. Teachers and students treat one another with dignity and respect acknowledging that each individual is created in the image and likeness of God. 2. Students are expected to complete all assignment honestly avoiding cheating, plagiarism, and other unethical behaviors. 3. Communal prayer is encouraged to start or end every class.
Integration of Scripture and Church Teaching
1. Teachers and students will look for natural connections between occurrences and accounts told within the Bible and mathematical concepts being discussed in class (e.g., Abraham's descendants being as numerous as the stars, multiplication of the loaves and fish, etc.) 2. Teachers will attempt to make connections between topics covered and ways in which students can help our Church and community.
Historic Church Figures and Events
1. Students will research or learn about famous mathematicians who were Saints or historic figures in the Church and analyze their contributions to the field of Mathematics.

7th Grade

Ratios & Proportional Relationships

1. **The student will be able to analyze proportional relationships to solve real-world and mathematical problems.**
   Students will demonstrate mastery of this standard by:
   - 1.1. Computing unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units.
   - 1.2. Recognizing and representing proportional relationships between quantities:
     - 1.2.1. Deciding whether two quantities are in a proportional relationship
     - 1.2.2. Identifying the constant of proportionality in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.
     - 1.2.3. Representing proportional relationships by equations.
     - 1.2.4. Explaining what a point (x,y) on the graph of a proportional relationship means in terms of the situation, with special attention to the points (0,0) and (1,r) where r is the unit rate.
   - 1.3. Using proportional relationships to solve multistep ratio and percent problems.

The Number System

1. **The student will be able to apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.**
   Students will demonstrate mastery of this standard by:
   - 1.1. Applying and extending previous understanding of addition and subtraction to add and subtract rational numbers; representing addition and subtraction on a horizontal or vertical number line.
     - 1.1.1. Describing situations in which opposite quantities combine to make 0.
     - 1.1.2. Understanding that p + q as the number is located a distance q from p, in the positive or negative direction
     - 1.1.3. Showing that a number and its opposite have an exact sum of 0.
     - 1.1.4. Understanding subtraction of rational numbers as adding the additive inverse.
     - 1.1.5. Applying properties of operations as strategies to add and subtract rational numbers.
   - 1.2. Applying and extending previous understanding of multiplication and division and of fractions to multiply and divide rational numbers.
     - 1.2.1. Understanding that multiplication is extended from fractions to rational numbers by requiring that operations continue to satisfy the properties of operations.
     - 1.2.2. Interpreting products of rational numbers by describing real-world contexts.
     - 1.2.3. Applying properties of operations as strategies to multiply and divide rational numbers.
     - 1.2.4. Converting a rational number to a decimal using long division; knowing that the decimal form of a rational number terminates in0s or eventually repeats.
   - 1.3. Solving real-world and mathematical problems involving the four operations with rational numbers.

Expressions and Equations

1. **The students will be able to use properties of operations to generate equivalent expressions.**
   Students will demonstrate mastery of this standard by:
   1.1. Applying properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.
   1.2. Understanding that rewriting an expression in different forms in a problem context can shed light on the problem and how the quantities are related.
2. **The students will be able to solve real-life and mathematical problems using numerical and algebraic expressions and equations.**
   Students will demonstrate mastery of this standard by:
   2.1. Solving multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form, using tools strategically.
   2.2. Applying properties of operations to calculate with numbers in any form, converting between forms as appropriate
   2.3. Assessing the reasonableness of answers using mental computations and estimation strategies.
   2.4. Using variables to represent quantities in a real-world or mathematical problem and constructing simple equations and inequalities to solve problems by reasoning about the quantities.
   2.5. Fluently solving word problems that lead to equations or inequalities of the form $px+q=r$ or $p(x+q)=r$ or $px+q>r$ or $px+q<r$
   2.6. Comparing an algebraic solution to an arithmetic solution and identifying the sequence of the operations used in each approach.

Geometry

1. **The students will be able to draw, construct, and describe geometrical figures and describe the relationships between them.**
   Students will demonstrate mastery of this standard by:
   1.1. Solving problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.
   1.2. Drawing geometric shapes with given conditions, focusing 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.
   1.3. Describing the two-dimensional figures that result from slicing three-dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids.
2. **The students will be able to solve real-life and mathematical problems involving angle measure, area, surface area, and volume.**
   Students will demonstrate mastery of this standard by:
   2.1. Knowing the formulas for the area and circumference of a circle and use them to solve problems; given an informal derivation of the relationship between the circumference and area of a circle.
   2.2. Using facts about supplementary, complementary, vertical, and adjacent angles in a multi-step problem to write and solve simple equations for an unknown angle in a figure.
   2.3. Solve real-world mathematical problems involving area, volume and surface area of two- and there-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.

Statistics & Probability

1. **The students will be able to use random sampling to draw inferences about a population.**
   Students will demonstrate mastery of this standard by:
   - 1.1. Understanding that statistics can be used to gain information about a population by examining a sample of the populations and understanding that generalizations about a population from a sample are valid only if the sample is representative of the population.
   - 1.2. Using data from a random sample to draw inferences about a population with an unknown characteristic of interests and generating multiple samples (or simulated samples) of the same size to gauge the variation estimates or predictions.
2. **The students will be able to draw informal comparative inferences about two populations.**
   Students will demonstrate mastery of this standard by:
   - 2.1. Informally assessing the degree of visual overlap of two numerical data distributions with similar variabilities, measuring the difference between the centers by expressing it as a multiple of a measure of variability.
   - 2.2. Using measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations.
3. **The students will be able to investigate chance processes to develop, use, and evaluate probability models.**
   Students will demonstrate mastery of this standard by:
   - 3.1. Understanding that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring and larger numbers indicate greater likelihood.
   - 3.2. Approximating 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.
   - 3.3. Developing a probability model and using it to find probabilities of events, comparing probabilities from a model to observed frequencies, and explain possible sources of discrepancy if the agreement is not good.
     - 3.3.1. Developing a uniform probability model by assigning equal probability to all outcomes and use the model to determine probabilities of events.
     - 3.3.2. Developing a probability model (which may not be uniform) by observing frequencies in data generated from a chance process.
   - 3.4. Finding probabilities of compound events using organized lists, tables, tree diagrams, and simulation.

Advanced 7th Grade Math

Ratios & Proportional Relationships
1. The student will be able to analyze proportional relationships to solve real-world and mathematical problems. **Students will demonstrate mastery of this standard by:** 1.1. Computing unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units. 1.2. Recognizing and representing proportional relationships between quantities: 1.2.1. Deciding whether two quantities are in a proportional relationship 1.2.2. Identifying the constant of proportionality in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships. 1.2.3. Representing proportional relationships by equations. 1.2.4. Explaining what a point (x,y) on the graph of a proportional relationship means in terms of the situation, with special attention to the points (0,0) and (1,r) where r is the unit rate. 1.3. Using proportional relationships to solve multistep ratio and percent problems.
The Number System
1. The student will be able to apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers. **Students will demonstrate mastery of this standard by:** 1.1. Applying and extending previous understanding of addition and subtraction to add and subtract rational numbers; representing addition and subtraction on a horizontal or vertical number line. 1.1.1. Describing situations in which opposite quantities combine to make 0. 1.1.2. Understand p + q as the number located a distance q from p, in the positive or negative direction 1.1.3. Showing that a number and its opposite have an exact sum of 0. 1.1.4. Understanding subtraction of rational numbers as adding the additive inverse. 1.1.5. Apply properties of operations as strategies to add and subtract rational numbers. 1.2. Applying and extending previous understanding of multiplication and division and of fractions to multiply and divide rational numbers. 1.2.1. Understanding that multiplication is extended from fractions to rational numbers by requiring that operations continue to satisfy the properties of operations. 1.2.2. Interpreting products of rational numbers by describing real-world contexts. 1.2.3. Understanding that integers can be divided, provided that the divisor is not zero, and every quotient of integers (with non-zero divisor) is a rational number. 1.2.4. Interpreting quotients of rational numbers by describing real-world contexts. 1.2.5. Applying properties of operations as strategies to multiply and divide rational numbers.

1.2.6. Converting a rational number to a decimal using long division; knowing that the decimal form of a rational number terminates in0s or eventually repeats.

1.3. Solving real-world and mathematical problems involving the four operations with rational numbers.

2. The student will be able to know that there are numbers that are not rational and approximate them by rational numbers.

Students will demonstrate mastery of this standard by:

2.1. Knowing that numbers that are not rational are called irrational and understanding informally that every number has a decimal expansion; for rational numbers showing that the decimal expansion repeats eventually and convert a decimal expansion which repeats eventually into a rational number.

2.2. Using rational approximations of irrational numbers to compare the size of irrational numbers, locating them approximately on a number line diagram and estimating the value of expressions.

Expressions and Equations

1. The students will be able to use properties of operations to generate equivalent expressions.

Students will demonstrate mastery of this standard by:

1.1. Applying properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.

1.2. Understanding that rewriting an expression in different forms in a problem context can shed light on the problem and how the quantities are related.

2. The students will be able to solve real-life and mathematical problems using numerical and algebraic expressions and equations.

Students will demonstrate mastery of this standard by:

2.1. Solving multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form, using tools strategically.

2.2. Applying properties of operations to calculate with numbers in any form, converting between forms as appropriate

2.3. Assessing the reasonableness of answers using mental computations and estimation strategies.

2.4. Using variables to represent quantities in a real-world or mathematical problem and constructing simple equations and inequalities to solve problems by reasoning about the quantities.

2.5. Fluently solving word problems that lead to equations or inequalities of the form $px+q=r$ or $p(x+q)=r$ or $px+q>r$ or $px+q<r$

2.6. Comparing an algebraic solution to an arithmetic solution and identifying the sequence of the operations used in each approach.

3. The students will be able to work with radical and integer exponents.

Students will demonstrate mastery of this standard by:

3.1. Knowing and applying the properties of integer exponents to generate equivalent numerical expressions.

3.2. Using 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 and evaluating square roots of small perfect squares and cube roots of small perfect cubes.

3.3. Using numbers expressed in the form 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.

3.4. Performing operations with numbers expressed in scientific notation, including problems where both decimals and scientific notation are used; using scientific notation and choosing units of appropriate size for measurements of very large or very small quantities.

3.5. Interpreting scientific notation that has been generated by technology.

4. The student will be able to understand the connections between proportional relationships, lines, and linear equations.

Students will demonstrate mastery of this standard by:

4.1. Graphing proportional relationships, interpreting the unit rate as the slope of the graph; comparing two different proportional relationships represented in different ways.

4.2. Using 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; deriving the equations y=mx for a line through the origin and the equation y=mx+b for a line intercepting the vertical axis as b.

5. The students will be able to analyze and solve linear equations and pairs of simultaneous linear equations.

Students will demonstrate mastery of this standard by:

5.1. Giving examples of linear equations in one variable with one solution, infinitely many solutions, or no solution; showing 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).

5.2. Solving linear equations and inequalities with rational number coefficients, including those whose solutions require expanding expressions using the distributive property and collecting like terms.

Geometry

1. The students will be able to draw, construct, and describe geometrical figures and describe the relationships between them.

Students will demonstrate mastery of this standard by:

1.1. **The students will be able to draw, construct, and describe geometrical figures and describe the relationships between them.**

Students will demonstrate mastery of this standard by:

1.2. Solving problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.

1.3. Drawing geometric shapes with given conditions, focusing 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.

1.4. Describing the two-dimensional figures that result from slicing three-dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids.

2. The students will be able to solve real-life and mathematical problems involving angle measure, area, surface area, and volume.

Students will demonstrate mastery of this standard by:

2.1. Knowing the formulas for the area and circumference of a circle and use them to solve problems; given an informal derivation of the relationship between the circumference and area of a circle.

2.2. Using facts about supplementary, complementary, vertical, and adjacent angles in a multi-step problem to write and solve simple equations for an unknown angle in a figure.
2.3. Solve real-world mathematical problems involving area, volume and surface area of two- and there-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.

3. The students will be able to understand congruence and similarity using physical models, transparencies, or geometry software.
Students will demonstrate mastery of this standard by:
3.1. Verifying experimentally the properties of rotations, reflections, and translations.
3.2. Understanding 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; describing a sequence that exhibits the congruence between two congruent figures.
3.3. Describing the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.
3.4. Understanding that two-dimensional figures are similar to one another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; describing a sequence that exhibits the similarity between two similar two-dimensional figures.
3.5. Using informal arguments to establish facts about the angle sum an 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.

4. The student will be able to solve real-world and mathematical problems involving volume of cylinders, cones, and spheres.
Students will demonstrate mastery of this standard by:
4.1. Knowing the formulas for the volumes of cones, cylinders, and spheres and using them to solve real-world and mathematical problems.

Statistics & Probability

1. The students will be able to use random sampling to draw inferences about a population.
Students will demonstrate mastery of this standard by:
1.1. Understanding that statistics can be used to gain information about a population by examining a sample of the populations and understanding that generalizations about a population from a sample are valid only if the sample is representative of the population.
1.2. Using data from a random sample to draw inferences about a population with an unknown characteristic of interests and generating multiple samples (or simulated samples) of the same size to gauge the variation estimates or predictions.

2. The students will be able to draw informal comparative inferences about two populations.
Students will demonstrate mastery of this standard by:
2.1. Informally assessing the degree of visual overlap of two numerical data distributions with similar variabilities, measuring the difference between the centers by expressing it as a multiple of a measure of variability.
2.2. Using measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations.

3. The students will be able to investigate chance processes and develop, use, and evaluate probability models.

Students will demonstrate mastery of this standard by:

3.1. Understanding that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring and larger numbers indicate greater likelihood.

3.2. Approximating 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.

3.3. Developing a probability model and using it to find probabilities of events, comparing probabilities from a model to observed frequencies, and explain possible sources of discrepancy if the agreement is not good.

3.3.1. Developing a uniform probability model by assigning equal probability to all outcomes and use the model to determine probabilities of events.

3.3.2. Developing a probability model (which may not be uniform) by observing frequencies in data generated from a chance process.

3.4. Finding probabilities of compound events using organized lists, tables, tree diagrams, and simulation.

8th Grade

The Number System
1. The student will be able to show that there are numbers that are not rational, and approximate them by rational numbers. **Students will demonstrate mastery of this standard by:** 1.1. Knowing that numbers that are not rational are called irrational and understanding that every number has a decimal expansion; showing that the decimal expansion of rational numbers eventually repeats and converting a decimal expansion which repeats eventually into a rational number 1.2. Using rational approximations of irrational numbers to compare size of irrational numbers, locating them approximately on a number life diagram, and estimating the value of expressions
Expressions & Equations
1. The students will be able to work with radicals and integer exponents. **Students will demonstrate mastery of this standard by:** 1.1. Knowing and applying the properties of integer exponents to generate equivalent numerical expressions 1.2. Using square root and cute root symbols to represent solutions to equations of the form $x^2=p$ and $x^3=p$ where p is a positive rational number and evaluating the square roots of small perfect squares and cube roots of small perfect cubes 1.3. Using numbers express 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 1.4. Performing operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used and using scientific notation and choosing units of appropriate size for measurements of very large or very small quantities 1.5. Interpreting scientific notation that has been generated by technology **2. The students will be able to understand the connection between proportional relationships, lines, and linear equations.** **Students will demonstrate mastery of this standard by:** 2.1. Graphing proportional relationships, interpreting the unit rate at the slope of the graph and comparing two different proportional relationships represented in different ways 2.2. Using similar triangles to explain why the slope *m* is the same between any two distinct points on a non-vertical line in the coordinate plan; deriving 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 **3. The student will be able to analyze and solve linear equations and pairs of simultaneous linear equations.** **Students will demonstrate mastery of this standard by:** 3.1. Solving linear equations with one variable 3.2. Giving examples of linear equations with one variable with one solution, infinitely many solutions, or no solutions, and showing 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

3.3. Solving linear equations and inequalities with rational number coefficients, including those whose solutions require expanding expressions using the distributive property and collecting like terms
3.4. Understanding that solutions to a system of two linear equations in two variables corresponds to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously
3.5. Solving systems of two linear equations in two variables algebraically and estimate solutions by graphing the equations
3.6. Solving real-world mathematical problems leading to two linear equations in two variables

Functions

1. **The student will be able to define, evaluate, and compare functions.**
   Students will demonstrate mastery of this standard by:
   1.1. Understanding that a function is a rule that assigns to each input exactly one output, and the graph of a function is the set of ordered pairs consisting of an input and the corresponding output.
   1.2. Comparing properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions)
   1.3. Interpreting the equations y=mx+b as defining a linear function, whose graph is a straight line
   1.4. Giving examples of functions that are not linear
2. **The students will be able to use functions to model relationships between quantities.**
   Students will demonstrate mastery of this standard by:
   2.1. Constructing a function to model a linear relationship between two quantities and determining the rate of change and initial value of the function from a description of a relationship or from two values, including reading these from a table or from a graph
   2.2. Interpreting the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values
   2.3. Describing qualitatively the functional relationship between two quantities by analyzing a graph
   2.4. Sketching a graph that exhibits the qualitative features of a function that has been described verbally

Geometry

1. **The students will be able to understand congruence and similarity using physical models, transparencies, or geometry software.**
   Students will demonstrate mastery of this standard by:
   1.1. Verifying experimentally the properties of rotations, reflections, and translations
   1.2. Understanding that a two-dimensional figure is congruent to another if the second one can be obtained from the first by a sequence of rotations, reflections, and translations; describing a sequence that exhibits the congruence between two congruent figures
   1.3. Describing the effects of dilation, translations, rotations, and reflections on two-dimensional figures using coordinates
   1.4. Understanding that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflection, translations, and dilations; describing a sequence that exhibits the similarity between two similar two-dimensional figures

1.5. Using 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

2. The students will be able to understand and apply the Pythagorean Theorem.
Students will demonstrate mastery of this standard by:

2.1. Explaining a proof of the Pythagorean Theorem and its converse

2.2. Applying the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions

2.3. Applying the Pythagorean Theorem to find the distance between two points in a coordinate system

3. The students will be able to solve real-world and mathematical problems involving volume of cylinders, cones, and spheres.
Students will demonstrate mastery of this standard by:

3.1. Knowing the formulas for the volumes of cones, cylinders, and spheres and using them to solve real-world and mathematical problems

Statistics and Probability

1. The students will be able to investigate patterns of association in bivariate data.
Students will demonstrate mastery of this standard by:

1.1. Constructing and interpreting scatter plots for bivariate measurement data to investigate patterns of association between two quantities

1.2. Describing patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association

1.3. Knowing that straight lines are used widely to model relationships between two quantitative variables

1.4. Informally fitting a straight line, and informally assessing the model fit by judging the closeness of the data points to the line

1.5. Using the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept

1.6. Understanding that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table

1.7. Constructing and interpreting a two-way table summarizing data on two categorical variables collected from the same subjects; using relative frequencies calculated for rows or columns to describe possible association between the two variables

Advanced 8th Grade Math with Algebra I

Number & Quantity- The Real Number System (R-RN)
1. The students will use properties of rational and irrational numbers. **Students will demonstrate mastery of this standard by:** 1.1. Explaining why the sum or product of two rational numbers is rational 1.2. Explaining why the sum of a rational number and an irrational number is irrational 1.3. Explaining why the product of a nonzero rational number and an irrational number is irrational
Number & Quantity- Quantities (N-Q)
1. The students will be able to reason quantitatively and use units to solve problems. **Students will demonstrate mastery of this standard by:** 1.1. Using units as a way to understand problems and to guide the solution of multi-step problems and choosing and interpreting units consistently in formulas 1.2. Choosing and interpreting the scale and the origin in graphs and data displays 1.3. Defining appropriate quantities for the purpose of descriptive modeling. 1.4. Choosing a level of accuracy appropriate to limitations on measurement when reporting quantities
Algebra- Expressions & Expressions
1. The students will be able to analyze and solve linear equations and pairs of simultaneous linear equations. **Students will demonstrate mastery of this standard by:** 1.1. Understanding 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 1.2. Solving systems of two linear equations in two variables algebraically and estimating solution by graphing equations and solving simple cases by inspection 1.3. Solving real-world and mathematical problems leading to two linear equations in two variables
Algebra- Seeing Structure in Expressions (A-SSE)
1. The students will be able to interpret the structure of expressions. **Students will demonstrate mastery of this standard by:** 1.1. Interpreting expressions that represent a quantity in terms of its context 1.2. Interpreting complicated expressions by viewing one or more of their parts as a single entity 1.3. Using the structure of an expression to identify ways to rewrite it **2. The students will be able to write expressions in equivalent forms to solve problems.** **Students will demonstrate mastery of this standard by:** 2.1. Choosing and producing an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression 2.2. Factoring a quadratic expression to reveal the zeros of the function it defines 2.3. Completing the square in a quadratic expression to reveal the maximum or minimum value of the function it defines

2.4. Using the properties of exponents to transform expressions for exponential functions

Algebra- Arithmetic with Polynomials & Rational Expressions (A-AAPR)

1. **The students will be able to perform arithmetic operations on polynomials.**
   Students will demonstrate mastery of this standard by:
   1.1. Understanding that polynomials form a system analogous to the integers, namely they are closed under the operations of addition, subtraction, and multiplication
   1.2. Adding, subtracting, and multiplying polynomials
2. **The students will be able to understand the relationship between zeros and factors of polynomials.**
   Students will demonstrate mastery of this standard by:
   2.1. Identifying zeros of polynomials when suitable factorizations are available and use the zeros to construct a rough graph of the function defined by the polynomial

Creating Equations (A-CED)

1. **The students will be able to create equations that describe numbers or relationships.**
   Students will demonstrate mastery of this standard by:
   1.1. Creating equations and inequalities in on variable and suing them to solve problems
   1.2. Creating equations in two variables to represent relationships between quantities and graphing equations on coordinate axes with labels and scaled
   1.3. Representing constraints by equations or inequalities, and by systems of equations and/ or inequalities, and interpreting solutions as viable or non-viable options in a modeling context
   1.4. Rearranging formulas to highlight a quantity of interest, using the same reasoning as in solving equations

Reasoning with Equations and Inequalities (A-REI)

1. **The students will be able to understand solving equations as a process of reasoning and explaining the reasoning.**
   Students will demonstrate mastery of this standard by:
   1.1. Explaining 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
   1.2. Constructing a viable argument to justify a solution method
2. **The students will be able to solve equations and inequalities with one variable.**
   Students will demonstrate mastery of this standard by:
   2.1. Solving linear equations and inequalities in on variable, including equations with coefficients represented by letters
   2.2. Solving quadratic equations in on variable using 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 solution, and deriving the quadratic formula from this form
   2.3. Solving 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; recognizing when the quadratic formula give complex solutions

3. The students will be able to solve systems of equations.
Students will demonstrate mastery of this standard by:
3.1. Giving a system of two equations in two variables, show and explain why the sum of equivalent forms of the equations produces the same solution as the original system
3.2. Solving systems of linear equations algebraically, exactly, and graphically while focusing on pairs of linear equations in two variables

4. The students will be able to represent and solve equations and inequalities graphically.
Students will demonstrate mastery of this standard by:
4.1. Understanding that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plan, often forming a curve
4.2. Explaining 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)
4.3. Finding the solution approximately, using technology to graph the function, making tables of values or finding successive approximations
4.4. Graphing the solutions to a linear inequality in two variables as a half-plane and graphing the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes

Functions (F)

1. The students will be able to define, evaluate, and compare functions.
Students will demonstrate mastery of this standard by:
1.1. Understanding that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output
1.2. Comparing properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions)
1.3. Interpreting the equation $y = mx + b$ as defining a linear function, whose graph is a straight line; give examples of functions that are not linear

2. The student will be able to use functions to model relationships between quantities.
Students will demonstrate mastery of this standard by:
2.1. Constructing a function to model a linear relationship between two quantities
2.2. Determining 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
2.3. Interpreting the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values
2.4. Describing qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear)
2.5. Sketching a graph that exhibits the qualitative features of a function that has been described verbally

Interpreting Functions (F-IF)

1. The students will understand the concept of a function and use function notation.
Students will demonstrate mastery of this standard by:
1.1. Understanding that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If *f* is a function and *x* is an element of its domain, then

f(x) denotes the output of *f* corresponding to the input x. The graph of *f* is the graph of the equation *y* = *f*(x)

1.2. Using function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context

1.3. Recognizing that sequences are functions whose domain is a subset of the integers

2. The students will be able to interpret functions that arise in applications in terms of the context.

Students will demonstrate mastery of this concept by:

2.1. For a function that models a relationship between two quantities, interpreting 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)*

2.2. Relating the domain of a function to its graph and, where applicable, to the quantitative relationship it describes (*e.g., 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)*

2.3. Calculating and interpreting the average rate of change of a function (presented symbolically or as a table) over a specified interval; Estimating the rate of change from a graph

Building Functions (F-BF)

1. The students will be able to build a function that models a relationship between two quantities.

Students will demonstrate mastery of this standard by:

1.1. Writing a function that describes a relationship between two quantities and determining an explicit expression or steps for calculation from a context

2. The students will be able to build a new function from existing functions.

Students will demonstrate mastery of this standard by:

2.1. Identifying 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. Including recognizing even and odd functions from their graphs and algebraic expressions for them

Linear, Quadratic, and Exponential Models (F-LE)*

1. The students will be able to build a construct linear, quadratic, and exponential models and solve problems.

Students will demonstrate mastery of this standard by:

1.1. Distinguishing between situations that can be modeled with linear functions and with exponential functions

1.2. Proving that linear functions grow by equal differences over equal intervals and that exponential functions grow by equal factors over equal intervals.

1.3. Recognizing situations in which one quantity changes at a constant rate per unit interval relative to another

1.4. Recognizing situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another

1.5. Constructing 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)

2. The students will be able to interpret expressions for function in terms of the situation they model.
Students will demonstrate mastery of this standard by:
2.1. Interpreting the parameters in a linear or exponential function in terms of a context

Geometry

1. The students will be able to apply the Pythagorean Theorem.
Students will demonstrate mastery of this standard by:
1.1. Explaining a proof of the Pythagorean Theorem and its converse
1.2. Applying the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.
1.3. Applying the Pythagorean Theorem to find the distance between two points in a coordinate

Statistics and Probability

1. The students will be able to investigate patterns of association in bivariate data.
Students will demonstrate mastery of this standard by:
1.1. Constructing and interpreting scatter plots for bivariate measurement data to investigate patterns of association between two quantities.
1.2. Describing patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association
1.3. Knowing 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 assessing the model fit by judging the closeness of the data points to the line
1.4. Using the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. E.g., 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
1.5. Understanding 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 subject
1.6. Using relative frequencies calculated for rows or columns to describe possible association between the two variables

Interpreting Categorical and Quantitative Data (S-ID)

1. The students will be able to summarize, represent, and interpret data on a single count or measurement variable.
Students will demonstrate mastery of this standard by:
1.1. Representing and analyze data with plots on the real number line (dot plots, histograms, and box plots)
1.2. Using statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets
1.3. Interpreting differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers)

2. The students will be able to interpret linear models.
Students will demonstrate mastery of this standard by:

2.1. Interpreting the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data
2.2. Computing (using technology) and interpret the correlation coefficient of a linear fit
2.3. Distinguishing between correlation and causation

Algebra I

The Real Number System (R-RN)
1. The students will be able to use properties of rational and irrational numbers. **Students will demonstrate mastery of this standard by:** 1.1. Explaining why the sum or product of two rational numbers is rational 1.2. Explaining why the sum of a rational number and an irrational number is irrational 1.3. Explaining why the product of a nonzero rational number and an irrational number is irrational
Quantities (N-Q)
1. The students will be able to reason quantitatively and use units to solve problems. **Students will demonstrate mastery of this standard by:** 1.1. Using units as a way to understand problems and to guide the solution of multi-step problems; choosing and interpreting units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays 1.2. Defining appropriate quantities for the purpose of descriptive modeling 1.3. Choosing a level of accuracy appropriate to limitations on measurement when reporting quantities
Seeing Structures in Expressions (A-SSE)
1. The students will be able to interpret the structure of expressions. **Students will demonstrate mastery of this standard by:** 1.1. Interpreting parts of an expression, such as terms, factors, and coefficients. 1.2. Interpreting complicated expressions by viewing one or more of their parts as a single entity. E.g., interpret P(1+r)n as the product of P and a factor not depending on P 1.3. Using the structure of an expression to identify ways to rewrite it. E.g., see x4 – y4 as (x2)2 – (y2)2 thus recognizing it as a difference of squares that can be factored as (x2– y2) (x2 + y2) **2. The students will be able to write expressions in equivalent forms to solve problems.** **Students will demonstrate mastery of this standard by:** 2.1. Choosing and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression 2.2. Factoring a quadratic expression to reveal the zeros of the function it defines. 2.3. Completing the square in a quadratic expression to reveal the maximum or minimum value of the function it defines 2.4. Using the properties of exponents to transform expressions for exponential functions
Arithmetic with Polynomials and Rational Expressions (A-APR)
1. The students will be able to perform arithmetic operations on polynomials. **Students will demonstrate mastery of this standard by:** 1.1. Understanding 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

2. The students will be able to understand the relationship between zeros and factors of polynomials.

Students will demonstrate mastery of this standard by:

2.1. Identifying zeros of polynomials when suitable factorizations are available and using the zeros to construct a rough graph of the function defined by the polynomial (limit to 1st- and 2nddegree polynomials)

Creating Equations

1. The students will be able to create equations that describe numbers or relationships.

Students will demonstrate mastery of this standard by:

1.1. Creating equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions

1.2. Creating equations in two variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales

1.3. Representing 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. E.g., represent inequalities describing nutritional and cost constraints on combinations of different foods

1.4. Rearranging formulas to highlight a quantity of interest, using the same reasoning as in solving equations. E.g., rearrange Ohm's law V = IR to highlight resistance R

Reasoning with Equations and Inequalities (A-REI)

1. The students will be able to understand solving equations as a process of reasoning and explain the reasoning.

Students will demonstrate mastery of this standard by:

1.1. Explaining 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

1.2. Constructing a viable argument to justify a solution method

2. The students will be able to solve equations and inequalities in one variable.

Students will demonstrate mastery of this standard by:

2.1. Solving linear equations and inequalities in one variable, including equations with coefficients represented by letters

2.2. Solving quadratic equations in one variable by using 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 and deriving the quadratic formula from this form.

2.3. Solving quadratic equations by inspection (e.g., for x2 = 49), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation and recognize when the quadratic formula gives complex solutions

3. The students will be able to represent and solve equations and inequalities graphically.

Students will demonstrate mastery of this standard by:

3.1. Showing and explaining why the sum of equivalent forms of the equations produces the same solution as the original system when given a system of two equations in two variables

3.2. Solving systems of linear equations algebraically, exactly, and graphically while focusing on pairs of linear equations in two variables

4. The students will be able to represent and solve equations and inequalities graphically.

Students will demonstrate mastery of this standard by:

4.1. Understanding 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)

4.2. Explaining 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, quadratic, absolute value, and exponential functions

4.3. Graphing 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

Interpreting Functions

1. The students will be able to understand the concept of a function and use function notation.

Students will demonstrate mastery of this standard by:

1.1. Understanding 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

1.2. Understanding that If f is a function and x is an element of its domain, then f(x) denotes the output of f corresponding to the input x. The graph of f is the graph of the equation y = f(x)

1.3. Using function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

1.4. Recognizing that sequences are functions whose domain is a subset of the integers

2. The students will be able to interpret functions that arise in applications in terms of the context.

Students will demonstrate mastery of this standard by:

2.1. Interpreting key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship for a function that models a relationship between two quantities (Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity)

2.2. Relating the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. E.g., 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

2.3. Calculating and interpreting the average rate of change of a function (presented symbolically or as a table) over a specified interval; estimating the rate of change from a graph

3. **The students will be able to analyze functions using different representations.**
   Students will demonstrate mastery of this standard by:
   - 3.1. Graphing functions (linear and quadratic) and show intercepts, maxima, and minima
   - 3.2. Graphing square root and piecewise-defined functions, including absolute value functions
   - 3.3. Writing a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function
   - 3.4. Using 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
   - 3.5. Comparing properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). E.g., given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum

Building Functions

1. **The students will be able to build a function that models a relationship between two quantities.**
   Students will demonstrate mastery of this standard by:
   - 1.1. Writing a function that describes a relationship between two contexts
   - 1.2. Determining an explicit expression or steps for calculation from a context
2. **The students will be able to build new functions from existing functions.**
   Students will demonstrate mastery of this standard by:
   - 2.1. Identifying the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative)
   - 2.2. Finding the value of k given the graphs
   - 2.3. Experimenting with cases and illustrate an explanation of the effects on the graph using technology

Linear, Quadratic, and Exponential Models (F-LE)

1. **The students will be able to build a construct linear, quadratic, and exponential models and solve problems.**
   Students will demonstrate mastery of this standard by:
   - 1.1. Distinguishing between situations that can be modeled with linear functions and with exponential functions
   - 1.2. Proving that linear functions grow by equal differences over equal intervals and that exponential functions grow by equal factors over equal intervals
   - 1.3. Recognizing situations in which one quantity changes at a constant rate per unit interval relative to another
   - 1.4. Recognizing situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another
   - 1.5. Constructing 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)
2. **The students will be able to interpret expressions for function in terms of the situation they model.**
   Students will demonstrate mastery of this standard by:
   - 2.1. Interpreting the parameters in a linear or exponential function in terms of a context

Interpreting Categorical and Quantitative Data

1. **The students will be able to summarize, represent, and interpret data on a single count or measurement variable.**
   Students will demonstrate mastery of this standard by:
   - 1.1. Representing and analyze data with plots on the real number line (dot plots, histograms, and box plots)
   - 1.2. Using statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets
   - 1.3. Interpreting differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers)
2. **The students will be able to summarize, represent, and interpret data on two categorical and quantitative variables.**
   Students will demonstrate mastery of this standard by:
   - 2.1. 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) while recognizing possible associations and trends in the data
   - 2.2. Representing data on two quantitative variables on a scatter plot, and describe how the variables are related
   - 2.3. Fitting a function to the data; use functions fitted to data to solve problems in the context of the data; using a given functions or choose a function suggested by the context (emphasizing linear, quadratic, and exponential models)
   - 2.4. Informally assessing the fit of a function by plotting and analyzing residuals.
   - 2.5. Fitting a linear function for a scatter plot that suggests a linear association.
3. **The students will be able to interpret linear models.**
   Students will demonstrate mastery of this standard by:
   - 3.1. Interpreting the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data
   - 3.2. Computing (using technology) and interpret the correlation coefficient of a linear fit
   - 3.3. Distinguishing between correlation and causation

Geometry

Congruence
1. The students will be able to experiment with transformations in the plane. **Students will demonstrate mastery of this standard by:** 1.1. Knowing 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 1.2. Representing transformations in the plane using, e.g., transparencies and geometry software 1.3. Describing transformations as functions that take points in the plane as inputs and give other points as outputs. 1.4. Comparing transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch). 1.5. Describing the rotations and reflections that carry it onto itself when given a rectangle, parallelogram, trapezoid, or regular polygon 1.6. Developing definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments 1.7. Draw the transformed figure when given a geometric figure and a rotation, reflection, or translation using graph paper, tracing paper, or geometry software 1.8. Specifying a sequence of transformations that will carry a given figure onto another **2. The students will be able to understand congruence in terms of rigid motions.** **Students will demonstrate mastery of this standard by:** 2.1. Using geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; using the definition of congruence in terms of rigid motions to decide if they are congruent when given two figures 2.2. Using 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 2.3. Explaining how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions **3. The students will be able to prove geometric theorems.** **Students will demonstrate mastery of this standard by:** 3.1. Proving theorems about lines and angles 3.2. Proving theorems about triangles 3.3. Proving theorems about parallelograms **4. The students will make geometric constructions.** **Students will demonstrate mastery of this standard by:** 4.1. Making formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, etc.) 4.2. Copying a segment and an angle and bisecting a segment or angle 4.3. 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

4.4. Constructing an equilateral triangle, a square, and a regular hexagon inscribed in a circle

Similarity, Right Triangles, and Trigonometry (G-SRT)

1. **The students will be able to understand similarity in terms of similarity transformations.**
   Students will demonstrate mastery of this standard by:
   1.1. Verify experimentally the properties of dilations given by a center and a scale factor including that a dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged and that the dilation of a line segment is longer or shorter in the ratio given by the scale factor
   1.2. Using the definition of similarity in terms of similarity transformations to
   1.3. decide if they are similar when given two figures; explaining using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.
   1.4. Using the properties of similarity transformations to establish the AA criterion for two triangles to be similar
2. **The students will be able to prove theorems involving similarity.**
   Students will demonstrate mastery of this standard by:
   2.1. Proving theorems about triangles including a line parallel to one side of a triangle divides the other two proportionally, and conversely, the Pythagorean Theorem
   2.2. Using congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures
3. **The students will be able to define trigonometric ratios and solve problems involving right triangles.**
   Students will demonstrate mastery of this standard by:
   3.1. Understanding that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles
   3.2. Explaining and using the relationship between the sine and cosine of complementary angles
   3.3. Using trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems

Circles

1. **The students will be able to understand and apply theorems about circles.**
   Students will demonstrate mastery of this standard by:
   1.1. Proving all circles are similar
   1.2. Identifying and describing relationship among inscribed angles, radii, and chords
   1.3. Constructing the inscribed and circumscribed circles of a triangle and proving properties of angles for a quadrilateral inscribed in a circle
2. **The students will be able to find arc lengths and areas of sectors of circles.**
   Students will demonstrate mastery of this standard by:
   2.1. Using similarity to show that the length of the arc intercepted by an angle is proportional to the radius and defining the radian measure of the angle as the constant of proportionality
   2.2. Deriving the formula for the area of a sector

Expressing Geometric Properties with Equations (G-GPE)

1. **The students will be able to translate between the geometric description and the equation for a conic section.**
   Students will demonstrate mastery of this standard by:
   1.1. Deriving the equation of a circle of given center and radius by using the Pythagorean Theorem
   1.2. Completing the square to find the center and radius of a circle given by an equation
2. **The students will be able to use coordinates to prove simple geometric theorems algebraically.**
   Students will demonstrate mastery of this standard by:
   2.1. Using coordinates to prove simple geometric theorems algebraically
   2.2. Proving the slope criteria for parallel and perpendicular lines and using them to solve geometric problems
   2.3. Finding the point on a directed line segment between two given points that partitions the segment in a given ratio
   2.4. Using coordinates to compute perimeter of polygons and areas of triangles and rectangles (e.g. using the distance formula)

Geometric Measurement and Dimension (G-GMD)

1. **The students will be able to explain volume formulas and use them to solve problems.**
   Students will demonstrate mastery of this standard by:
   1.1. Giving an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone using dissection arguments, Cavalieri's principle, and informal limit arguments
   1.2. Using volume formulas for cylinders, pyramids, cones, and spheres to solve problems
2. **The students will be able to visualize relationships between two-dimensional and three-dimensional objects.**
   Students will demonstrate mastery of this standard by:
   2.1. Identifying the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects

Modeling with Geometry (G-MG)

1. **The students will be able to apply geometric concepts in modeling situations.**
   Students will demonstrate mastery of this standard by:
   1.1. Using geometric shapes, their measures, and their properties to describe objects
   1.2. Applying concepts of density based on area and volume in modeling situations
   1.3. Applying geometric methods to solve design problems

Algebra II

The Real Number System (N-RN)
1. The students will be able to extend the properties of exponents to rational exponents. **Students will demonstrate mastery of this standard by:** 1.1. Explaining 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 1.2. Rewriting expressions involving radical and rational exponents using the properties of exponents
Quantities (N-Q)
1. The students will be able to reason quantitatively and use units to solve problems. **Students will demonstrate mastery of this standard by:** 1.1. Defining appropriate quantities for the purpose of descriptive modeling
The Complex Number System (N-CN)
1. The students will be able to perform arithmetic operations with complex numbers. **Students will demonstrate mastery of this standard by:** 1.1. Knowing there is a complex number i such that i^2=-1, and every complex number has the form of a + bi with a and b real 1.2. Using the relation i^2=-1 and the commutative, associate, and distributive properties to add, subtract, and multiply complex numbers **2. The students will be able to use complex numbers in polynomial identities and equations.** **Students will demonstrate mastery of this standard by:** 2.1. Solving quadratic equations with real coefficients that have complex solutions
Seeing Structure in Expressions (A-SSE)
1. The students will be able to interpret the structure of expressions. **Students will demonstrate mastery of this standard by:** 1.1. Using the structure of an expression to identify ways to rewrite it **2. The students will be able to write expressions in equivalent forms to solve problems.** **Students will demonstrate mastery of this standard by:** 2.1. Choosing and producing an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression 2.2. Using properties of exponents to transform expressions for exponential functions 2.3. Deriving the formula for the sum of a finite geometric series (when the common ratio is not 1), and using the formula to solve problems
Arithmetic with Polynomials and Rational Expressions (A-APR)
1. The students will be able to understand the relationship between zeros and factors of polynomials. **Students will demonstrate mastery of this standard by:** 1.1. Knowing and applying 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)

1.2. Identifying zeros of polynomials when suitable factorizations are available and use the zeros to construct a rough graph of the function defined by the polynomial (limit to 1st- and 2nddegree polynomials)

2. **The students will be able to use polynomial identities to solve problems.**
   Students will demonstrate mastery of this standard by:
   2.1. Proving polynomial identities and using them to describe numerical relationships (For example, the polynomial identity (x2 + y2)2 = (x2 – y2)2 + (2xy)2 can be used to generate Pythagorean triples)
3. **The students will be able to rewrite rational expressions.**
   Students will demonstrate mastery of this standard by:
   3.1. Rewriting simple rational expressions in different forms
   3.2. Writing a(x)/b(x) in the form q(x) + r(x)/b(x), where a(x), b(x), q(x), and r(x) are polynomials with the degree of r(x) less than the degree of b(x), using inspection, long division, or, for the more complicated examples, a computer algebra system

Creating Equations (A-CED)

1. **The students will be able to create equations that describe numbers or relationships.**
   Students will demonstrate mastery of this standard by:
   1.1. Creating equations and inequalities in one variable and use them to solve problems; Including equations arising from linear and quadratic functions, and simple rational and exponential function
   1.2. Creating equations in two or more variables to represent relationships between quantities; graphing equations on coordinate axes with labels and scales
   1.3. Representing constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpreting solutions as viable or non-viable options in a modeling context

Reasoning with Equations and Inequalities (A-REI)

1. **The students will be able to understand solving equations as a process of reasoning and explain the reasoning.**
   Students will demonstrate mastery of this standard by:
   1.1. Explaining 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.
   1.2. Constructing a viable argument to justify a solution method.
   1.3. Solving simple rational and radical equations in one variable, and giving examples showing how extraneous solutions may arise.
2. **The students will be able to solve equations and inequalities in one variable**
   Students will demonstrate mastery of this standard by:
   2.1. Solving quadratic equations in one variable by inspection, taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation
   2.2. Recognizing when the quadratic formula gives complex solutions
3. **The students will be able to solve systems of equations.**
   Students will demonstrate mastery of this standard by:
   3.1. Solving systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables

3.2. Solving a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically

4. The students will be able to represent and solve equations and inequalities graphically.

Students will demonstrate mastery of this standard by:

4.1. Explaining 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)

4.2. Finding the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations; Including cases where f(x) and/or g(x) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions

Interpreting Functions

1. The student will be able to understand the concept of a function and use function notation.

Students will demonstrate mastery of this standard by:

1.1. Recognizing that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers

2. The students will be able to interpret functions that arise in applications in terms of the context.

Students will demonstrate mastery of this standard by:

2.1. Interpreting key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship, for a function that models a relationship between two quantities (key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity)

2.2. Calculating and interpreting the average rate of change of a function (presented symbolically or as a table) over a specified interval

2.3. Estimating the rate of change from a graph

3. The students will be able to analyze functions using different representations.

Students will demonstrate mastery of this standard by:

3.1. Graphing functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases

3.2. Graphing polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior

3.3. Graphing exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude

3.4. Writing a function defined by an expression in different but equivalent forms to reveal and explaining different properties of the function

3.5. Using the properties of exponents to interpret expressions for exponential functions

3.6. Comparing properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions)

Linear, Quadratic, and Exponential Models (F-LE)

1. **The students will be able to construct and compare linear, quadratic, and exponential models and solve problems.**
   Students will demonstrate mastery of this standard by:
   1.1. Constructing 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)
   1.2. Observing, using graphs and tables, that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function
   1.3. For exponential models, expressing 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
2. **The students will be able to interpret expressions for functions in terms of the situation they model.**
   Students will demonstrate mastery of this standard by:
   2.1. Interpreting the parameters in a linear or exponential function in terms of a context

Trigonometric Functions (F-TF)

1. **The students will be able to extend the domain of trigonometric functions using the unit circle**
   Students will demonstrate mastery of this standard by:
   1.1. Understanding radian measure of an angle as the length of the arc on the unit circle subtended by the angle
   1.2. Explaining 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

Interpreting Categorical and Quantitative Data (S-ID)

1. **The students will be able to summarize, represent, and interpret data on a single count or measurement variable.**
   Students will demonstrate mastery of this standard by:
   1.1. Using the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages
   1.2. Recognizing that there are data sets for which such a procedure is not appropriate.
   1.3. Using calculators, spreadsheets, and tables to estimate areas under the normal curve
2. **The student will be able to summarize, represent, and interpret data on two categorical and quantitative variables**
   Students will demonstrate mastery of this standard by:
   2.1. Representing data on two quantitative variables on a scatter plot, and describing how the variables are related
   2.2. Fitting a function to the data
   2.3. Using functions fitted to data to solve problems in the context of the data

Making Inferences and Justifying Conclusions (S-IC)

1. **The students will be able to understand and evaluate random processes underlying statistical experiments.**
   Students will demonstrate mastery of this standard by:
   1.1. Understanding statistics as a process for making inferences about population parameters based on a random sample from that population
   1.2. Deciding if a specified model is consistent with results from a given data-generating process e.g., using simulation
2. **The students will be able to make inferences and justify conclusions from sample surveys, experiments, and observational studies.**
   Students will demonstrate mastery of this standard by:
   2.1. Recognizing the purposes of and differences among sample surveys, experiments, and observational studies; explaining how randomization relates to each
   2.2. Using data from a sample survey to estimate a population mean or proportion; developing a margin of error through the use of simulation models for random sampling
   2.3. Using data from a randomized experiment to compare two treatments; using simulations to decide if differences between parameters are significant
   2.4. Evaluating reports based on data

Conditional Probability and the Rules of Probability (S-CP)

1. **The students will be able to understand independence and conditional probability and use them to interpret data.**
   Students will demonstrate mastery of this standard by:
   1.1. Describing events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events ("or," "and," "not")
   1.2. Understanding that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent
   1.3. Understanding the conditional probability of A given B as P(A and B)/P(B), and interpreting independence of A and B as saying that the conditional probability of A given B is the same as the probability of A, and the conditional probability of B given A is the same as the probability of B
   1.4. Constructing and interpreting two-way frequency tables of data when two categories are associated with each object being classified; using the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities
   1.5. Recognizing and explaining the concepts of conditional probability and independence in everyday language and everyday situations
2. **The students will be able to use the rules of probability to compute probabilities of compound events in a uniform probability model.**
   Students will demonstrate mastery of this standard by:
   2.1. Finding the conditional probability of A given B as the fraction of B's outcomes that also belong to A, and interpret the answer in terms of the model
   2.2. Applying the Addition Rule, P(A or B) = P(A) + P(B) – P(A and B), and interpret the answer in terms of the model

Algebra III

Number and Quantity
1. The students will explore and illustrate the characteristics and operations connecting sequences and series. **The students will demonstrate mastery of this standard by:** 1.1. Expressing sequences and series using recursive and explicit formulas 1.2. Evaluating and applying formulas for arithmetic and geometric sequences and series 1.3. Calculating limits based on convergent and divergent series 1.4. Evaluating and applying infinite geometric series 1.5. Extending the meaning of exponents to include rational numbers 1.6. Simplifying expressions with fractional exponents to include converting from radicals 1.7. Factoring algebraic expressions containing fractional exponents
Algebra
1. The students will be able to analyze and manipulate functions. **Students will demonstrate mastery of this standard by:** 1.1. Determining characteristics of graphs of parent functions (domain/ range, increasing/ decreasing intervals, intercepts, symmetry, end behavior, and asymptotic behavior) 1.2. Determining the end behavior of polynomial functions **2. The students will be able to use polynomial identities to solve problems.** **Students will demonstrate mastery of this standard by:** 2.1. Proving polynomial identities and using them to describe numerical relationships. e.g., the polynomial identity $(x^2 + y^2)^2 = (x^2 – y^2)^2 + (2xy)^2$ can be used to generate Pythagorean triples 2.2. Verifying the Binomial Theorem by mathematical induction or by a combinatorial argument 2.3. Knowing and applying 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 2.4. Writing rational expressions in simplest form 2.5. Decomposing a rational function into partial fractions 2.6. Determining asymptotes and holes of rational functions, explaining how each was found, and relating these behaviors to continuity **3. The students will be able to perform operations on expressions, equations, inequalities and polynomials.** **Students will demonstrate mastery of this standard by:** 3.1. Adding, subtracting, multiplying and dividing rational expressions 3.2. Solving polynomial and rational inequalities; relating results to the behavior of the graphs 3.3. Finding the composite of two given functions and finding the inverse of a given function; extending this concept to discuss the identity function f(x) = x

3.4. Simplifying complex algebraic fractions (with/without variable expressions and integer exponents) to include expressing $\frac{f(x\ h)\ f(x)}{h}$ as a single simplified fraction when f(x) = 1/ 1-x for example
3.5. Finding the possible rational roots using the Rational Root Theorem
3.6. Finding the zeros of polynomial functions by synthetic division and the Factor Theorem
3.7. Graphing and solving quadratic inequalities

Functions

1. **The students will be able to analyze functions using different representations.**
   Students will demonstrate mastery of this standard by:
   1.1. Graphing functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases
   1.2. Graphing rational function, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior
2. **The students will be able to build a function that models a relationship between two quantities.**
   Students will demonstrate mastery of this standard by:
   2.1. Composing functions
3. **The students will be able to build new functions from existing functions.**
   Students will demonstrate mastery of this standard by:
   3.1. Verifying by composition that one function is the inverse of another
   3.2. Reading values of an inverse function from a graph or a table, given that the function has an inverse
   3.3. Producing an invertible function from a non-invertible function by restricting the domain
   3.4. Understanding the inverse relationship between exponents and logarithms and using this relationship to solve problems involving logarithms and exponents
4. **The students will be able to extend the domain of trigonometric functions using the unit circle.**
   Students will demonstrate mastery of this standard by:
   4.1. Using special triangles to determine geometrically the values of sine, cosine, tangent, for π/3, π/4, and π/6, and using the unit circle to express the values of sine, cosine, and tangent for π-x, π+x, and 2 π-x in terms of their values for x, where x is any real number
   4.2. Using the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions
5. **The students will be able to model periodic phenomena with trigonometric functions using the unit circle.**
   Students will demonstrate mastery of this standard by:
   5.1. Choosing trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline
   5.2. Understanding that restricting a trigonometric function to a domain on which it is always increasing or always decreasing allows its inverse to be constructed

5.3. Using inverse functions to solve trigonometric equations that arise in modeling contexts; evaluating the solutions using technology and interpreting them in terms of the context.

6. The students will be able to prove and apply trigonometric identities.
Students will demonstrate mastery of this standard by:

6.1. Proving the addition and subtraction formulas for sine, cosine, and tangent and using them to solve problems

6.2. Proving the Pythagorean identity $\sin^2(\Theta) + \cos^2(\Theta) = 1$ and us it to find (Θ), $\cos(\Theta)$, or $\tan(\Theta)$ given $\sin(\Theta)$, $\cos(\Theta)$, or $\tan(\Theta)$ and the quadrant of the angle

Geometry

1. The students will be able to recognize, sketch, and transform graphs of functions.
Students will demonstrate mastery of this standard by:

1.1. Graphing piecewise defined functions and determine continuity or discontinuities

1.2. Describing the attributes of graphs and the general equations of parent functions (linear, quadratic, cubic, absolute value, rational, exponential, logarithmic, square root, cube root, and greatest integer)

1.3. Explaining the effects of changing the parameters in transformations of functions

1.4. Predicting the shapes of graphs of exponential, logarithmic, rational, and piece-wise functions, and verifying the prediction with and without technology

1.5. Relating symmetry of the behavior of even and odd functions

2. The students will be able to apply trigonometry to general triangles.
Students will demonstrate mastery of this standard by:

2.1. Deriving the formula A=1/2 ab sin(C) for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side

2.2. Proving the Laws of Sines and Cosines and using them to solve problems

2.3. Understanding and applying the Law of Sines and the Laws of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems, resultant forces)

Statistics and Probability

1. The students will be able to explore and apply fundamental principles of probability.
Students will demonstrate mastery of this standard by:

1.1. Analyzing expressions in summation and factorial notation to solve problems

1.2. Proving statements using mathematical induction

Trigonometry and Pre-Calculus

The Complex Number System (N-CN)
1. The students will be able to perform arithmetic operations with complex numbers. **Students will demonstrate mastery of this standard by:** 1.1. Finding the conjugate of a complex number 1.2. Using conjugates to find moduli and quotients of complex numbers **2. The students will be able to represent complex numbers and their operations on the complex plane.** **Students will demonstrate mastery of this standard by:** 2.1. Representing complex numbers on the complex plane in rectangular and polar form (including real and imaginary numbers), and explaining why the rectangular and polar forms of a given complex number represent the same number 2.2. Representing addition, subtraction, multiplication, and conjugation of complex numbers geometrically on the complex plane and using properties of this representation for computation 2.3. Calculating the distance between numbers in the complex plane as the modulus of the difference, and the midpoint of a segment as the average of the numbers at its endpoints **3. The students will be able to use complex numbers in polynomial identities and equations.** **Students will demonstrate mastery of this standard by:** 3.1. Extending polynomial identities to the complex numbers 3.2. Knowing the Fundamental Theorem of Algebra and showing that it is true for quadratic polynomials
Vector and Matrix Quantities (N-VM)
1. The students will be able to represent and model with vector quantities. **Students will demonstrate mastery of this standard by:** 1.1. Recognizing vector quantities as having both magnitude and direction 1.2. Representing vector quantities by directed line segments and using appropriate symbols for vectors and magnitudes 1.3. Finding the components of a vector by subtracting the coordinates of an initial point from the coordinates of a terminal point 1.4. Solving problems involving velocity and other quantities that can be represented by vectors 1.5. Adding vectors end-to-end, component wise, and by the parallelogram rule, and understanding that the magnitude of a sum of two vectors is typically not the sum of the magnitudes 1.6. Determining the magnitude and direction of the sum of two vectors given in magnitude and direction form 1.7. Understanding vector subtraction **v – w** as **v + (-w),** where **-w** is the additive inverse of **w**, with the same magnitude as **w** and pointing in the opposite direction 1.8. Representing vector subtraction graphically by connecting the tips in the appropriate order, and performing vector subtraction component-wise

1.9. Representing scalar multiplication graphically by scaling vectors and possibly reversing their direction
1.10. Performing scalar multiplication component-wise
1.11. Computing the magnitude of a scalar multiple **cv** using $\|cv\| = |c|v$
1.12. Computing the direction of **cv** knowing that when $|c|v \neq 0$, the direction of **cv** is either along v(for c >0) or against v (for c<0)

2. The students will be able to perform operations on matrices and use matrices in applications.
Students will demonstrate mastery of this standard by:
2.1. Using matrices to represent and manipulate data, e.g., to represent payoffs or incidence relationships in a network
2.2. Multiplying matrices by scalars to produce new matrices, e.g., as when all the payoffs in a game are doubled
2.3. Adding, subtracting, and multiplying matrices of appropriate dimensions
2.4. Understanding that, unlike multiplication of numbers, matrix multiplication for square matrices is not a commutative operation, but still satisfies the associative and distributive properties
2.5. Understanding that the zero and identity matrices play a role in matrix addition and multiplication similar to the role of 0 and 1 in the real numbers; the determinant of a square matrix is nonzero if and only if the matrix has a multiplicative inverse
2.6. Multiplying a vector (regarded as a matrix with one column) by a matrix of suitable dimensions to produce another vector
2.7. Working with matrices as transformation of vectors
2.8. Working with 2x2 matrices as transformations of the plane, and interpreting the absolute value of the determinant in terms of area

Arithmetic with Polynomials and Rational Expressions (A-APR)

1. The students will be able to use polynomial identities to solve problems.
Students will demonstrate mastery of this standard by:
1.1. Knowing and applying 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

2. The students will be able to rewrite rational expressions.
Students will demonstrate mastery of this standard by:
2.1. Understanding that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression
2.2. Adding, subtracting, multiplying and dividing rational expressions

Reasoning with Equations and Inequalities (A-REI)

1. The students will be able to solve systems of equations.
Students will demonstrate mastery of this standard by:
1.1. Representing a system of linear equations as a single matrix equation in a vector variable
1.2. Finding the inverse of a matrix if it exists and using it to solve systems of linear equations (using technology for matrices of dimensions 3x3 or greater)

Interpreting Functions

1. **The students will be able to analyze functions using different representations.**
   Students will demonstrate mastery of this standard by:
   1.1. Graphing functions expressed symbolically and showing key features of the graph, by hand in simple cases and suing technology for more complicated cases
   1.2. Graphing rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior

Building Functions (F-BF)

1. **The students will be able to build a function that models a relationship between two quantities.**
   Students will demonstrate mastery of this standard by:
   1.1. Composing functions
2. **The students will be able to build new functions from existing functions.**
   Students will demonstrate mastery of this standard by:
   2.1. Finding inverse functions
   2.2. Verifying by composition that one function is the inverse of another
   2.3. Reading values of an inverse function from a graph or a table, given that eh function has an inverse
   2.4. Producing an invertible function from a non-invertible function by restricting the domain
   2.5. Understanding the inverse relationship between exponents and logarithms and using this relationship to solve problems involving logarithms and exponents

Trigonometric Functions (F-TF)

1. **The students will be able to extend the domain of trigonometric functions using the unit circle.**
   Students will demonstrate mastery of this standard by:
   1.1. Using special triangles to determine geometrically the values of sine, cosine, tangent for π/3, π/4, and π/6, and using the unit circle to express the values of sine, cosine, and tangent for π-x, π+x, and 2 π-x in terms of their values of x, where x is any real number
   1.2. Using the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions
2. **The students will be able to model periodic phenomena with trigonometric functions.**
   Students will demonstrate mastery of this standard by:
   2.1. Choosing trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline
   2.2. Understanding that restricting a trigonometric function to a domain on which it is always increasing or always decreasing allows its inverse to be constructed
   2.3. Using inverse functions to solve trigonometric equations that arise in modeling contexts; evaluating the solutions using technology, and interpreting them in terms of the context
3. **The students will be able to prove and apply trigonometric identities>**
   Students will demonstrate mastery of this standard by:
   3.1. Proving the addition and subtraction formulas for sine, cosine, and tangent and using them to solve problems

Similarity, Right Triangles, and Trigonometry (G-SRT)

1. **The students will be able to apply trigonometry to general triangles.**
   Students will demonstrate mastery of this standard by:
   1.1. Deriving the formula, $A = \frac{1}{2} ab \sin(C)$ for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side
   1.2. Proving the Laws of Sines and Cosines and using them to solve problems
   1.3. Understanding and applying the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems, resultant forces)

Circles (G-C)

1. **The students will be able to understand and apply theorems about circles.**
   Students will demonstrate mastery of this standard by:
   1.1. Constructing a tangent line from a point outside a given circle to the circle

Geometric Measurement and Dimension (G-GMD)

1. **The students will be able to explain volume formulas and use them to solve problems.**
   Students will demonstrate mastery of this standard by:
   1.1. Giving and informal argument using Cavalieri's principle for the formulas for the volume of a sphere and other solid figures

Conditional Probability and the Rules of Probability

1. **The students will be able to use the rules of probability to compute probabilities of compound events in a uniform probability model.**
   Students will demonstrate mastery of this standard by:
   1.1. Applying the general Multiplication Rule in a uniform probability model, $P(A \text{ and } B) = P(A)P(B \mid A)$, and interpreting the answer in terms of the model
   1.2. Using permutations and combinations to compute probabilities of compound events and solving problems

Using Probability to Make Decisions (S-MD)

1. **The students will be able to calculate expected values and use them to solve problems.**
   Students will demonstrate mastery of this standard by:
   1.1. Defining a random variable for a quantity of interest by assigning a numerical value to each event in a sample space
   1.2. Graphing corresponding probability distribution using the same graphical displays as for data distribution
   1.3. Calculating the expected value of a random variable and interpreting it as the mean of the probability distribution
   1.4. Developing a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated and finding the expected value
   1.5. Developing probability distribution for a random variability defined for a sample space in which probabilities are assigned empirically and finding the expected value
2. **The students will be able to use probability to evaluate outcomes of a decision.**
   Students will demonstrate mastery of this standard by:
   2.1. Weighing possible outcomes of a decision by assigning probabilities to payoff values and finding expected values
   2.2. Finding the expected payoff for a game of chance

2.3. Evaluating and comparing strategies on the basis of expected values
2.4. Using probabilities to make fair decisions
2.5. Analyzing decisions and strategies using probability concepts

Calculus

Number and Quantity
1. The students will be able to compute and determine the reasonableness of results in mathematical and real-world situations. **Students will demonstrate mastery of this standard by:** 1.1. Estimating limits from graphs or tables 1.2. Estimating numerical derivatives from graphs or tables of data 1.3. Proving statements using mathematical induction
Algebra
1. The students will be able to demonstrate basic knowledge of functions, including their behavior and characteristics. **Students will demonstrate mastery of this standard by:** 1.1. Predicting and explaining the characteristics and behaviors of functions and their graphs (domain, range, increasing/ decreasing intervals, intercepts, symmetry, and end behavior) 1.2. Investigating, describing, and determining asymptotic behavior using tables, graphs, and analytical methods 1.3. Determining and justifying the continuity and discontinuity of functions **2. The students will be able to evaluate limits and communicate an understanding of the limiting process.** **Students will demonstrate mastery of this standard by:** 2.1. Solving mathematical situations and application problems involving or using derivatives, including exponential, logarithmic, and trigonometric functions 2.2. Calculating limits using algebraic methods 2.3. Verifying the behavior and direction of non-determinable limits **3. The students will be able to use the definition of formal rules of differentiation to compute derivatives.** **Students will demonstrate mastery of this standard by:** 3.1. Stating and applying the formal definition of a derivative 3.2. Applying differentiation rules to sums, products, quotients, and powers of the functions 3.3. Using the chain rule and implicit differentiation 3.4. Describing the relationship between differentiability and continuity **4. The students will be able to apply derivative to find solutions in a variety of situations.** **Students will demonstrate mastery of this standard by:** 4.1. Defining a derivative and explaining the purpose/ utility of the derivative 4.2. Applying the derivative as a rate of change in varied contexts, including velocity, speed, and acceleration 4.3. Applying the derivative to find tangent lines and normal lines to given curves at given points 4.4. Predicting and explaining the relationships between functions and their derivatives 4.5. Modeling rates of change to solve related rate problems 4.6. Solving optimization problems

5. The students will be able to employ various integration properties and techniques to evaluate integrals.
Students will demonstrate mastery of this standard by:
5.1. Stating and applying the First and Second Fundamental Theorems of Calculus
5.2. Applying the power rule and u-substitution to evaluate indefinite integrals

Geometry

1. The students will be able to use geometric concepts to gain insights into, answer questions about, and graph various implication of differentiation.
Students will demonstrate mastery of this standard by:
1.1. Demonstrating and explaining the differences between average and instantaneous rates of change
1.2. Applying differentiation techniques to curve sketching
1.3. Applying Rolle's Theorem and the Mean Value Theorem and their geometric consequences
1.4. Identifying and applying local linear approximations
1.5. Analyzing curves with attention to non-decreasing functions (monotonicity) and concavity

Statistics and Probability

1. The students will be able to adapt integration methods to model situations in problems.
Students will demonstrate mastery of this standard by:
1.1. Applying integration to solve problems of area
1.2. Utilizing integrals to model and find solutions to real-world problems such as calculating displacement and total distance traveled

2. The students will be able to apply appropriate techniques, tools, and formulas to determine values for the definite integral.
Students will demonstrate mastery of this standard by:
2.1. Interpreting the concept of definite integral as a limit of Riemann sums over equal subdivisions