Catholic Schools Office
Archdiocese of Boston

Curriculum Framework

Mathematics, Grades PreK-8 [including Algebra I]

Table of Contents

Pre-K

Intellectual and Dispositional Standards

1. Demonstrate an initial understanding of the connection between mathematics and problem solving, and display a sense of wonder about mathematics as a way of knowing/understanding the world more clearly.
2. Recognize that a number represents a specific quantity and connect that quantity to written symbols.
3. Use a variety of different methods (e.g., drawing pictures, using objects, acting out) to represent real-life problem situations.
4. With guidance and support, determine what the most appropriate tools are to help solve or make sense of a range of different problem situations.
5. Explain their thinking in response to questions such as "How did you get that?" or "Why is that true?" using specific reference to objects, pictures, drawings, or actions.
6. Use developmentally appropriate language when discussing their mathematical reasoning.
7. With guidance and support, recognize basic patterns and identify the beauty, harmony, proportion, and radiance present in these patterns.
8. Demonstrate an initial understanding of the effect of repetitive actions in counting and computation (e.g., when counting by tens, that the next number in the sequence will be ten more than the previous number).
9. Show interest in the pursuit of understanding basic mathematical concepts as a way to address problems.
10. With guidance and support, identify how solving difficult mathematical problems and operations can be a joyful experience.

Content, Knowledge, and Skills Standards

Counting and Sequence

1. Listen to and say the names of numbers in meaningful contexts.
2. Recognize and name written numerals 0–10.
3. Understand the relationships between numerals and quantities up to ten.
4. Count many kinds of concrete objects and actions up to ten, using one-to-one correspondence, and accurately count as many as seven things in a scattered configuration.
5. Use comparative language (such as more/less than, equal to) to compare and describe collections of objects.

Operations and Algebraic Thinking

6. Understand addition as putting together and adding to, and understand subtraction as taking apart and taking from.
7. Use concrete objects to model real-world addition (putting together) and subtraction (taking away) problems up through five.

Measurement and Data

8. Recognize the attributes of length, area, weight, and capacity of everyday objects using appropriate vocabulary.
9. Through play, compare the attributes of length and weight for two objects, including longer/shorter, same length; heavier/lighter, same weight; holds more/less, holds the same amount.
10. Sort, categorize, and classify objects by more than one attribute.
11. Through play, recognize that certain objects are coins and that dollars and coins represent money.

Geometry

12. Identify and describe shapes (squares, circles, triangles, rectangles).
13. Identify relative positions of objects in space, and use appropriate spatial language to describe those positions.
14. Identify various two-dimensional shapes using appropriate language.
15. Through play and exploration, create and represent three-dimensional shapes (ball/sphere, square box/cube, tube/cylinder) using various manipulative materials (such as popsicle sticks, blocks, pipe cleaners, pattern blocks).

Kindergarten

Intellectual and Dispositional Standards

1. Demonstrate an initial understanding of the connection between mathematics and problem solving, and display a sense of wonder about mathematics as a way of knowing/understanding the world more clearly.
2. Recognize that a number represents a specific quantity and connect that quantity to written symbols.
3. Use a variety of different methods (e.g., writing numbers, drawing pictures, using objects, acting out) to represent real-life problem situations.
4. With guidance and support, determine what the most appropriate tools are to help solve or make sense of a range of different problem situations.
5. Explain their thinking in response to questions such as "How did you get that?" or "Why is that true?" using specific reference to objects, pictures, drawings, or actions.
6. Use developmentally appropriate, clear, and precise language when discussing their mathematical reasoning.
7. With guidance and support, recognize basic numerical and operational patterns and identify the beauty, harmony, proportion, and radiance present in these mathematical patterns.
8. Demonstrate an initial understanding of the effect of repetitive actions in counting and computation (e.g., when counting by tens, that the next number in the sequence will be ten more than the previous number).
9. Show interest in the pursuit of understanding mathematics for its own sake and as a way to solve problems addressing social justice issues in local and global communities.
10. With guidance and support, identify how solving difficult mathematical problems and operations can be a joyful experience and can reveal the importance of inquiry and learning through mathematical processes.

Content, Knowledge, and Skills Standards

Counting and Sequence

1. Count to 100 by ones and by tens.
2. Count forward beginning from a given number within a known sequence.
3. Write numbers from 0 to 20; represent a number of objects with a written numeral 0–20 (with 0 representing a count of no objects).
4. Understand the relationship between numbers and quantities when counting.
5. Identify whether the number of objects in one group is greater than, less than, or equal to the number of objects in another group by using matching and counting strategies.

Operations and Algebraic Thinking

6. Understand addition as putting together and adding to, and understand subtraction as taking apart and taking from.
7. Represent addition and subtraction with objects, fingers, mental images, drawings, sounds (e.g., claps), acting out situations, verbal explanations, expressions, or equations.
8. Solve addition and subtraction word problems using objects or drawings to represent the problem, and add and subtract within 10.

9. Fluently add and subtract within 5.

Number and Operations

10. Compose and decompose numbers from 11 to 19 into ten ones and some further ones and record each composition or decomposition by a drawing, physical manipulation, or equation.
11. Understand that numbers from 11 to 19 are composed of ten ones and one, two, three, four, five, six, seven, eight, or nine ones.

Measurement and Data

12. Describe measurable attributes of objects, such as length or weight; describe several measurable attributes of a single object.
13. Directly compare two objects with a measurable attribute in common, to see which object has "more of"/"less of" the attribute, and describe the difference.
14. Classify objects into given categories; count the numbers of objects in each category and sort the categories by count.

Geometry

15. Identify and describe shapes (squares, circles, triangles, rectangles, hexagons, cubes, cones, cylinders, and spheres).
16. Describe objects in the environment using names of shapes, and describe the relative positions of these objects using terms such as above, below, beside, in front of, behind, and next to.
17. Correctly name shapes regardless of their orientations or overall size.
18. Identify shapes as two-dimensional (lying in a plane, "flat") or three-dimensional ("solid").
19. Analyze and compare two- and three-dimensional shapes, in different sizes and orientations, using informal language to describe their similarities, differences, parts, and other attributes.
20. Model shapes in the world by building shapes from components (e.g., sticks and clay balls) and by drawing shapes.
21. Compose simple shapes in order to form larger shapes.

First Grade

Intellectual and Dispositional Standards

1. Articulate that doing mathematics means noticing problem situations, solving problems, and discussing problem solutions, and display a sense of wonder about mathematics as a way of knowing/understanding the world more clearly.
2. Recognize that a number represents a specific quantity and connect that quantity to written symbols.
3. Use a variety of different methods (e.g., writing numbers and words, drawing pictures, using objects, acting out, making a chart or list) to represent real-life problem situations.
4. Determine what the most appropriate tools are to help solve or make sense of a range of different problem situations.
5. Explain their thinking and construct mathematical arguments using objects, pictures, drawings, and/or actions to help flesh out those arguments; communicate mathematical reasoning in conversations with peers.
6. Use developmentally appropriate, clear, and precise language when discussing mathematical reasoning.
7. Recognize numerical and operational patterns and structures (e.g., the commutative property of addition), and identify the beauty, harmony, proportion, and radiance present in these mathematical patterns.
8. Demonstrate an understanding of the effect of repetitive actions in counting and computation and the ability to question whether mathematical reasoning about these repetitive actions makes sense.
9. Show interest in the pursuit of understanding mathematics for its own sake and to enact change and justice in the world.
10. Identify how solving difficult mathematical problems and operations can be a joyful experience and can reveal the importance of inquiry and learning through mathematical processes.

Content, Knowledge, and Skills Standards

Operations and Algebraic Thinking

1. Use addition and subtraction within 20 to solve word problems (using objects, drawings, and equations), involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions.
2. Understand and apply properties of operations (e.g., commutative, associative, identity) and the relationship between addition and subtraction.
3. Add and subtract within 20 without the use of physical manipulatives, demonstrating fluency for addition and subtraction within 10; use mental strategies such as counting on, making ten, decomposing a number leading to a ten, using the relationship between addition and subtraction, and creating equivalent but easier or known sums.
4. Understand the meaning of the equal sign, and determine if equations involving addition and subtraction are true or false.
5. Write and solve number sentences from problem situations that express relationships involving addition and subtraction within 20.

Numbers and Operations

6. Count to 120, starting at any number less than 120; in this range, read and write numerals and represent a number of objects with a written numeral.
7. Understand that the two digits of a two-digit number represent amounts of tens and ones.
8. Compare two two-digit numbers based on the meanings of the tens and ones digits, recording the results of comparisons with the symbols >, =, and <.
9. Add within 100 (including adding a two-digit number and a one-digit number, and adding a two-digit number and a multiple of 10) using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used.
10. Subtract multiples of 10 in the range 10–90 from multiples of 10 in the range 10–90 (positive or zero differences), using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used.
11. Given a two-digit number, mentally find 10 more or 10 less than the number, without having to count; explain the reasoning used.

Measurement and Data

12. Order three objects by length; compare the lengths of two objects indirectly by using a third object.
13. Express the length of an object as a whole number of length units, by laying multiple copies of a shorter object (the length unit) end to end; understand that the length measurement of an object is the number of same-size length units that span it with no gaps or overlaps.
14. Tell and write time in hours and half-hours using analog and digital clocks.
15. Identify the values of all U.S. coins and know their comparative and equivalent values.
16. Organize, represent, and interpret data with up to three categories; ask and answer questions about the total number of data points, how many in each category, and how many more or less are in one category than in another.

Geometry

17. Distinguish between defining attributes (e.g., triangles are closed and three-sided) versus non-defining attributes (e.g., color, orientation, overall size); build and draw shapes that possess defining attributes.
18. Compose two-dimensional shapes (rectangles, squares, trapezoids, triangles, half-circles, and quarter-circles) or three-dimensional shapes (cubes, right rectangular prisms, right circular cones, and right circular cylinders) to create a composite shape, and compose new shapes from the composite shape.
19. Partition circles and rectangles into two and four equal shares, describe the shares using the words halves, fourths, and quarters, and use the phrases half of, fourth of, and quarter of. Describe the whole as two of, or four of the shares.

Second Grade

Intellectual and Dispositional Standards

1. Articulate that doing mathematics includes explaining what different problem situations mean, looking for ways to solve problems, identifying problem solutions, and checking their reasoning, and display a sense of wonder about mathematics as a way of knowing/understanding the world more clearly.
2. Demonstrate an ability to represent a mathematical problem situation quantitatively using basic numeric and operational quantitative reasoning.
3. Use a variety of different methods (e.g., writing numbers and words, drawing pictures, using objects, acting out, making a chart or list, creating equations) to represent real-life problem situations.
4. Determine what the most appropriate tools are to help solve or make sense of a range of different problem situations and demonstrate knowledge of the different strengths/weaknesses of different approaches to problem solving (e.g., drawing a picture vs. writing an equation).
5. Develop mathematical arguments (with or without reference to objects, pictures, drawings, and/or actions to help flesh out those arguments) and communicate mathematical reasoning in conversations with peers.
6. Use developmentally appropriate, clear, and precise language when discussing their mathematical reasoning.
7. Demonstrate the ability to find mathematical patterns and adopt mental math strategies based on those patterns, and to identify the beauty, harmony, proportion, and radiance present in these mathematical patterns.
8. Identify repetitive actions in counting and computation, adopt mental math strategies to incorporate the acquired knowledge represented by these actions, and question whether mental math models for these repetitive actions make sense.
9. Show interest in the pursuit of understanding mathematics for its own sake and as a way to solve problems addressing social justice issues in local and global communities.
10. Identify how joy can be experienced when solving difficult mathematical problems and operations, while also recognizing the importance of inquiry and learning through mathematical processes.

Content, Knowledge, and Skills Standards

Operations and Algebraic Thinking

1. Use addition and subtraction within 100 to solve one- and two-step word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem.
2. Fluently add and subtract within 20 using mental strategies and without the use of physical manipulatives; by end of grade 2, know from memory all sums of two one-digit number and know from memory related subtraction facts of sums of two one-digit numbers.
3. Determine whether a group of objects (up to 20) has an odd or even number of members; write an equation to express an even number as a sum of two equal addends.

Numbers and Operations

4. Understand that the three digits of a three-digit number represent amounts of hundreds, tens, and ones.
5. Count within 1000; skip-count by 5s, 10s, and 100s.
6. Compare two three-digit numbers based on meanings of the hundreds, tens, and ones digits, using >, =, and < symbols to record the results of comparisons.
7. Fluently add and subtract within 100 using strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.
8. Mentally add 10 or 100 to a given number 100–900, and mentally subtract 10 or 100 from a given number 100–900.

Measurement and Data

9. Measure and estimate lengths in standard units using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes.
10. Determine the differences between lengths using estimation and measurement techniques (using different units).
11. Use addition and subtraction within 100 to solve word problems involving lengths that are given in the same units, e.g., by using drawings (such as drawings of rulers) and equations with a symbol for the unknown number to represent the problem.
12. Represent whole numbers as lengths from 0 on a number line diagram with equally spaced points corresponding to the numbers 0, 1, 2, …, and represent whole-number sums and differences within 100 on a number line diagram.
13. Tell and write time from analog and digital clocks to the nearest five minutes, using a.m. and p.m.
14. Know the relationships of time, including seconds in a minute, minutes in an hour, hours in a day, days in a week, a month, and a year; and weeks in a month and a year.
15. Solve word problems involving dollar bills, quarters, dimes, nickels, and pennies, using $ and ¢ symbols appropriately.
16. Generate measurement data by measuring lengths of several objects to the nearest whole unit, or by making repeated measurements of the same object. Show the measurements by making a line plot, where the horizontal scale is marked off in whole-number units.
17. Draw a picture graph and a bar graph (with single-unit scale) to represent a data set with up to four categories; solve simple put-together/take-apart/compare problems using information presented in a bar graph.

Geometry

18. Recognize and draw shapes having specified attributes, such as a given number of angles or a given number of equal faces. Identify triangles, quadrilaterals, pentagons, hexagons, and cubes.
19. Partition a rectangle into rows and columns of same-size squares and count to find the total number of them.
20. Partition circles and rectangles into two, three, or four equal shares, describe the shares using the words halves, thirds, half of, a third of, etc., and describe the whole as two halves, three thirds, four fourths. Recognize that equal shares of identical wholes need not have the same shape.

Third Grade

Intellectual and Dispositional Standards

1. Demonstrate an understanding of what it means to do mathematics by regularly explaining the meaning of problem situations and looking for multiple ways to solve them, as well as displaying a sense of wonder about mathematics as a way of knowing/understanding the world more clearly.
2. Demonstrate an ability to represent a mathematical problem situation quantitatively using basic numeric and operational quantitative reasoning, in particular, the ability to connect abstract quantities in problems to written symbols and appropriate units.
3. Use numbers, mathematical language, equations, charts, and figures to demonstrate understanding of mathematical representations of real-life problem situations.
4. Determine what the most appropriate tools are to help solve or make sense of a range of different problem situations by comparing/contrasting the strengths/weaknesses of different approaches to problem solving.
5. Develop and refine mathematical arguments (with or without reference to objects, pictures, drawings, and/or actions to help flesh out those arguments) through frequent peer and student-to-teacher communication of mathematical reasoning in conversations.
6. Use developmentally appropriate, clear, and precise language when discussing mathematical reasoning, specifying units of measure and the meaning of symbols being discussed.
7. Use knowledge of previously learned mathematical patterns, rules, and structures to identify new patterns as well as the beauty, harmony, proportion, and radiance present in these newly discovered patterns.
8. Identify repetitive actions in counting and computation, adopt mental math strategies to incorporate the acquired knowledge represented by these actions, and question whether mental math models for these repetitive actions make sense.
9. Show interest in the pursuit of understanding mathematics for its own sake and as a way to solve problems addressing social justice issues in local and global communities.
10. Exhibit joy while solving difficult mathematical problems and operations, while also recognizing the importance of inquiry and learning through mathematical processes.

Content, Knowledge, and Skills Standards

Operations and Algebraic Thinking

1. Use the four operations (addition, subtraction, multiplication, and division) with whole numbers to solve problems with equal groups (especially for multiplication and division).
2. Understand conceptually how whole numbers are multiplied and divided into equal groups.
3. Solve multi-step word problems posed with whole numbers and having whole-number answers using the four operations.
4. Solve two-step word problems using the four operations; represent these problems using equations with a letter standing for the unknown quantity; assess the reasonableness of answers using mental computation and estimation strategies, including rounding.
5. Apply properties of operations, including the commutative, associative, and distributive properties, as strategies to multiply and divide.

6. Fluently multiply and divide within 100, using strategies such as the relationship between multiplication and division or properties of operations.
7. Know from memory all products of two one-digit numbers.

Numbers and Operations

8. Use place value understanding and properties of operations to perform multi-digit arithmetic (addition and subtraction) within 100.
9. Use place value understanding to round whole numbers to the nearest 10 or 100.
10. Multiply one-digit whole numbers by multiples of 10 in the range 10–90 using strategies based on place value and properties of operations.
11. Understand a fraction 1/b as the quantity formed by 1 part when a whole is partitioned into b equal parts; understand a fraction a/b as the quantity formed by a parts of size 1/b.
12. Understand a fraction as a number on the number line; represent fractions on a number line diagram.
13. Explain equivalence of fractions by examining numerical value or position on a number line, and compare fractions by reasoning about their size.
14. Compare two fractions with the same numerator or the same denominator by reasoning about their size. Recognize that comparisons are valid only when the two fractions refer to the same whole. Record the results of comparisons with the symbols >, =, or <, and justify the conclusions, e.g., by using a visual fraction model.
15. Solve word problems involving addition and subtraction of fractions referring to the same whole and having like denominators, e.g., by using visual fraction models and equations to represent the problem.

Measurement and Data

16. Solve problems involving measurement and estimation of intervals of time, liquid volumes, and masses of objects.
17. Tell and write time to the nearest minute and measure time intervals in minutes; solve word problems involving addition and subtraction of time intervals in minutes, e.g., by representing the problem on a number line diagram.
18. Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories; solve one- and two-step "how many more" and "how many less" problems using information presented in scaled bar graphs.
19. Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch; show the data by making a line plot, where the horizontal scale is marked off in appropriate units—whole numbers, halves, or quarters.
20. Recognize area as an attribute of plane figures and understand concepts of area measurement.
21. Measure areas by counting unit squares (e.g., square cm, square m, square in, square ft).
22. Understand concepts of area and relate area to multiplication and to addition.
23. Solve real-world and mathematical problems involving perimeters of polygons, including finding the perimeter given the side lengths, finding an unknown side length, and exhibiting rectangles with the same perimeter and different areas or with the same area and different perimeters.

Geometry

24. Understand that shapes in different categories (e.g., rhombuses, rectangles, and others) may share attributes (e.g., having four sides), and that the shared attributes can define a larger category (e.g., quadrilaterals). Recognize rhombuses, rectangles, and squares as examples of quadrilaterals, and draw examples of quadrilaterals that do not belong to any of these subcategories.

25. Partition shapes into parts with equal areas. Express the area of each part as a unit fraction of the whole.

26. Recognize a line of symmetry for a two-dimensional figure as a line across the figure such that the figure can be folded along the line into matching parts, identify line-symmetric figures, and draw lines of symmetry.

Fourth Grade

Intellectual and Dispositional Standards

1. Demonstrate an understanding of what it means to do mathematics by regularly explaining the meaning of problem situations and looking for multiple ways to solve them, as well as displaying a sense of wonder about mathematics as a way of knowing/understanding the world more clearly.
2. Demonstrate an ability to represent a mathematical problem situation quantitatively using quantitative reasoning, creating a logical representation with appropriate units and accurate meanings of the quantities involved in the problem.
3. Demonstrate an ability to experiment with the use of multiple methods of representing real-life problem situations (numbers, mathematical language, equations, charts, and figures) in order to explain the connections between the situation and the representation.
4. Determine what the most appropriate tools are to help solve or make sense of a range of different problem situations by comparing/contrasting the strengths/weaknesses of different approaches to problem solving.
5. Develop and refine mathematical arguments (making connections between models and equations represented in these arguments) through frequent peer and student-to-teacher communication of mathematical reasoning.
6. Use developmentally appropriate, clear, and precise language when discussing mathematical reasoning, specifying units of measure, the meaning of symbols being discussed, and the various parts of graphical representations of that reasoning.
7. Use knowledge of mathematical rules and operations to identify patterns and the beauty, harmony, proportion, and radiance present in patterns.
8. Use knowledge of repetitive actions in counting and computation to make generalizations about mathematical models and algorithms.
9. Show interest in the pursuit of understanding mathematics for its own sake and as a way to solve problems addressing social justice issues in local and global communities.
10. Exhibit joy while solving difficult mathematical problems and operations, while also recognizing the importance of inquiry and learning through mathematical processes.\

Content, Knowledge, and Skills Standards

Operations and Algebraic Thinking

1. Use the four operations (addition, subtraction, multiplication, and division) with whole numbers to solve problems.
2. Represent verbal statements with mathematical equations using appropriate operations and be able to conceptualize and discuss mathematical equations verbally.
3. Solve multi-step word problems posed with whole numbers and having whole-number answers using the four operations, including problems in which remainders must be interpreted.
4. Represent word problems using equations with a letter standing for the unknown quantity.
5. Assess the reasonableness of answers to word problems using mental computation and estimation strategies including rounding.
6. Gain familiarity with factors and multiples in the range 1-100.

7. Generate a number or shape pattern that follows a given rule.

Numbers and Operations

8. Understand place value for multi-digit numbers; for example, that a digit to the left represents ten times more than a digit to its right.
9. Compare two multi-digit numbers based on meanings of the digits in each place, using >, =, and < symbols to record the results of comparisons.
10. Use place value understanding to round multi-digit whole numbers to any place.
11. Use place value understanding and properties of operations to perform multi-digit arithmetic, including addition, subtraction, multiplication, and division.
12. Know multiplication facts and related division facts through 12×12.
13. Illustrate and explain multiplication and division calculations by using equations, rectangular arrays, and/or area models.
14. Extend understanding of fraction equivalence and ordering by using visual fraction models and common denominator/numerator strategies.
15. Build fractions from unit fractions by applying and extending previous understandings of operations on whole numbers (e.g., decomposing fractions into a sum of fractions with similar denominators, adding/subtracting mixed numbers with like denominators).
16. Solve word problems involving addition and subtraction of fractions referring to the same whole and having like denominators, e.g., by using visual fraction models and equations to represent the problem.
17. Apply and extend previous understandings of multiplication to multiply a fraction by a whole number; solve word problems involving multiplication of a fraction by a whole number.
18. Understand decimal notation equivalence for fractions, and compare decimal fractions.

Measurement and Data

19. Solve problems involving measurement and conversion of measurements from a larger unit to a smaller unit within a particular system of units.
20. Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, money, and perimeter and area, including problems involving simple fractions or decimals, and problems that require expressing measurements given in a larger unit in terms of a smaller unit.
21. Make a line plot to display a data set of measurements in fractions of a unit and solve problems involving addition and subtraction of fractions by using information presented in line plots.
22. Understand angle concepts and measure angles, including how angles are formed, how they are measured, and how they are compared.

Geometry

23. Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines and be able to identify these in two-dimensional figures.
24. Classify two-dimensional figures based on the presence or absence of parallel or perpendicular lines, or the presence or absence of angles of a specified size; recognize right triangles as a category and identify right triangles.

25. Recognize a line of symmetry for a two-dimensional figure as a line across the figure such that the figure can be folded along the line into matching parts, identify line-symmetric figures, and draw lines of symmetry.

Fifth Grade

Intellectual and Dispositional Standards

1. Solve mathematical problems (make sense of problem situations, look for multiple solutions, justify different problem solutions) and display a sense of wonder about mathematics as a way of knowing/understanding the world more clearly.
2. Demonstrate an ability to represent a mathematical problem situation quantitatively using quantitative reasoning, creating a logical representation with appropriate units, accurate meanings of the quantities involved in the problem, and precise expressions of mathematical concepts needed to represent those problems.
3. Use multiple methods of representing real-life problem situations (e.g., numbers, mathematical language, equations, charts, and figures) in order to evaluate the appropriateness of the results for making sense of problem solutions.
4. Determine what the most appropriate tools are to help solve or make sense of a range of different problem situations by comparing/contrasting the strengths/weaknesses of different approaches to problem solving.
5. Construct mathematical arguments and develop the ability to critique peers' mathematical arguments in frequent peer and student-to-teacher mathematical conversations.
6. Use developmentally appropriate, clear, and precise language when discussing mathematical reasoning.
7. Analyze patterns to determine whether or not those patterns fit a pre-established numerical or operational rule, and respond to the beauty, harmony, proportion, and radiance present in those patterns using mathematical language.
8. Use knowledge of repetitive actions to comprehend multiple different algorithms.
9. Show interest in the pursuit of understanding mathematics for its own sake and as a way to solve problems addressing social justice issues in local and global communities, drawing on the rich Catholic intellectual tradition and history of mathematical inquiry.
10. Exhibit joy while solving difficult mathematical problems and operations, while also recognizing the importance of inquiry and learning through mathematical processes.

Content, Knowledge, and Skills Standards

Operations and Algebraic Thinking

1. Write and interpret numerical expressions using mathematical symbols like parentheses, brackets, or braces.
2. Recognize relative difference (e.g., less than or greater than) or general estimation based on mathematical symbols used in a numerical expression.
3. Analyze patterns and relationships in multiple numbers or processes; for example, identify ordered pairs consisting of corresponding terms from the two patterns, and graph the ordered pairs on a coordinate plane.

Numbers and Operations

4. Understand the place value system by 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.

5. Explain patterns in the number of zeros of the product when multiplying a number by powers of 10 and explain patterns in the placement of the decimal point when a decimal is multiplied or divided by a power of 10.
6. Read, write, and compare decimals to thousandths.
7. Perform operations (add, subtract, multiply, and divide) with multi-digit whole numbers and with decimals to hundredths.
8. Use equivalent fractions as a strategy to add and subtract fractions.
9. Solve word problems involving addition and subtraction of fractions referring to the same whole, including cases of unlike denominators, e.g., by using visual fraction models or equations to represent the problem.
10. Apply and extend previous understandings of multiplication and division to multiply and divide fractions.
11. Solve real-world problems involving multiplication and division of fractions and mixed numbers, e.g., by using visual fraction models or equations to represent the problem.

Number System

12. Gain familiarity with concepts of positive and negative integers.

Measurement and Data

13. Convert like measurement units within a given measurement system.
14. Represent and interpret data using a line plot.
15. Understand concepts of volume and relate volume to multiplication and to addition in geometrical figures.

Geometry

16. Graph points on the coordinate plane to solve real-world and mathematical problems.
17. Classify two-dimensional figures into categories based on their properties (e.g., rectangles have four right angles, squares are rectangles, therefore squares have four right angles).

Sixth Grade

Intellectual and Dispositional Standards

1. Solve mathematical problems connected to real-life situations in order to describe the broader meaning of those problems/solutions and to articulate how a knowledge of mathematics leads to a deeper understanding of the world.
2. Use mathematical expressions, equations, and inequalities as a way to represent a wide variety of problem situations with real world contexts.
3. Model problem situations symbolically, graphically, tabularly, or contextually depending on the nature of the problem situation's context.
4. Use any and all available mathematical tools when creating solutions to problem situations based on an evaluation of a given tool's usefulness for the context of the problem situation.
5. Construct mathematical arguments using verbal or written explanations accompanied by expressions, equations, inequalities, models, graphs, tables, and data displays, and refine the ability to critique peers' mathematical arguments based on questioning and clear mathematical communication.
6. Use developmentally appropriate, clear, and precise language when discussing mathematical reasoning.
7. Demonstrate the ability to find and use appropriate patterns, rules, and operations in order to adequately model and solve problem situations with real world contexts that address social justice issues in local and global communities.
8. Use knowledge of different algorithms and the reasoning underlying those algorithms to make generalizations about recurring patterns sharing with others the beauty, harmony, proportion, radiance, and wholeness present in those patterns.
9. Show interest in the pursuit of understanding mathematics for its own sake and as a way to solve problems addressing social justice issues in local and global communities, drawing on the rich Catholic intellectual tradition and history of mathematical inquiry.
10. Exhibit joy while solving difficult mathematical problems and operations, while also recognizing the importance of inquiry and learning through mathematical processes.

Content, Knowledge, and Skills Standards

Ratios and Proportions

1. Understand ratio concepts (e.g., related to two quantities such as lengths, areas, and rates) and use ratio reasoning to solve problems.
2. Use ratio and rate reasoning to solve real-world and mathematical problems by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.
3. Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.\

Number System

4. Apply and extend previous understandings of multiplication and division to divide fractions by fractions.
5. Compute fluently with multi-digit numbers and find common factors and multiples.

6. Apply and extend previous understandings of numbers to the system of rational numbers (e.g., positive and negative numbers; number line positions).
7. Solve real-world and mathematical problems by graphing points in all four quadrants of the coordinate plane. Include use of coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate.

Expressions and Equations

8. Apply and extend previous understandings of arithmetic to algebraic expressions.
9. Reason about and solve one-variable equations and inequalities.
10. Represent and analyze quantitative relationships between dependent and independent variables.
11. Solve real-life and mathematical problems using variables representing two quantities.
12. 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.

Geometry

13. Solve real-world and mathematical problems involving area, surface area, and volume for figures such as right triangles, other triangles, special quadrilaterals, and polygons.
14. Use the relationships among radius, diameter, and center of a circle to find its circumference and area; solve real-world and mathematical problems involving the measurements of circles.
15. 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.

Statistics and Probability

16. Develop an understanding of statistical variability and the fact that a data set has a particular distribution defined by center, spread, and shape.
17. Summarize and describe distributions by displaying numerical data in plots on a number line, including dot plots, histograms, and box plots.
18. Summarize numerical data sets in relation to their context by reporting observations, frequencies, means and units of measurement, quantitative measures of center (e.g., mean/median), and variability in data patterns.

Seventh Grade

Intellectual and Dispositional Standards

1. Solve mathematical problems connected to real-life situations addressing social justice issues in local and global communities through the use of algebraic and geometric concepts in order to explain how finding mathematical solutions to real-world problem situations allow us to more clearly perceive our reality (informed by one's identity, culture, context, beliefs, values, and potential biases).
2. Use mathematical expressions, equations, and inequalities as a way to represent a wide variety of problem situations with real world contexts and compare those mathematical representations to other disciplinary approaches to those problem situations (e.g., theologically, philosophically).
3. Model problem situations symbolically, graphically, tabularly, and contextually while exhibiting both an appreciation for the ability to find meaning in the process of solving those problems and an openness to the idea that mathematical inquiry's infinite nature cannot be limited by those models.
4. Use any and all available mathematical tools when creating models for and solutions to problem situations based on an evaluation of a given tool's usefulness for the context of the problem situation.
5. Construct and critique mathematical arguments using verbal or written explanations accompanied by expressions, equations, inequalities, models, graphs, tables, and data displays.
6. Use developmentally appropriate, clear, and precise language when discussing mathematical reasoning.
7. Use appropriate patterns, rules, and operations in order to adequately model and solve problem situations with real world contexts addressing social justice issues in local and global communities.
8. Use algorithms and the reasoning underlying those algorithms to make generalizations about recurring patterns, sharing with others the mathematical knowledge that relates the beauty, harmony, proportion, radiance, and wholeness present in those patterns.
9. Show interest and a sense of wonder in the pursuit of understanding mathematics for its own sake and as a way to enact change and justice in the world, with an understanding that there are limitations to humanity's ability to fully comprehend all mathematical knowledge, drawing on the rich Catholic intellectual tradition and history of mathematical inquiry.
10. Exhibit joy while solving difficult mathematical problems found in creation and in community, while also recognizing the importance of inquiry and learning through mathematical processes.

Content, Knowledge, and Skills Standards

Ratios and Proportions

1. Analyze proportional relationships (e.g., lengths, areas, and rates) and use them to solve real-world and mathematical problems.
2. Recognize and represent proportional relationships between quantities in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.

3. Use proportional relationships to solve multistep ratio and percent problems.

Number System

4. Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.
5. Solve real-world and mathematical problems involving the four operations with rational numbers.

Expressions and Equations

6. Use properties of operations to generate equivalent expressions.
7. Solve real-life and mathematical problems using numerical and algebraic expressions and equations.
8. Use variables to represent quantities in word or mathematical problems, and construct simple equations and inequalities to solve problems by reasoning about the quantities.\

Geometry

9. Draw, construct, and describe geometrical figures and describe the relationships between them.
10. Solve problems involving scale drawings of geometric figures, such as computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.
11. Solve real-life and mathematical problems involving angle measure, area, surface area, and volume.
12. Know the formulas for the area and circumference of a circle and solve problems; give an informal derivation of the relationship between the circumference and area of a circle.
13. Use facts about supplementary, complementary, vertical, and adjacent angles in a multi-step problem to write and use them to solve simple equations for an unknown angle in a figure.

Statistics and Probability

14. Use random sampling to draw inferences about a population.
15. Draw informal comparative inferences about two populations.
16. Investigate chance processes and develop, use, and evaluate probability models.

Eighth Grade

Intellectual and Dispositional Standards

1. Solve mathematical problems that emerge from creation and our communities through the use of algebraic and geometric models in order to explain how finding mathematical solutions to these problem situations allows us to more clearly perceive our reality (informed by one's identity, culture, context, beliefs, values, and potential biases).
2. Use mathematical expressions, equations, and inequalities as a way to represent a wide variety of problem situations with real world contexts addressing social justice issues in local and global communities, and compare those mathematical representations to other disciplinary approaches to those problem situations (e.g., theologically, philosophically).
3. Model problem situations symbolically, graphically, tabularly, and contextually while exhibiting both an appreciation for the ability to find meaning in the process of solving those problems and an openness to the idea that mathematical inquiry's infinite nature cannot be limited by those models.
4. Use any and all available mathematical tools when modeling and solving problem situations based on their usefulness to the context of the problem situation.
5. Construct and critique mathematical arguments using verbal or written explanations accompanied by expressions, equations, inequalities, models, graphs, tables, and data displays.
6. Use developmentally appropriate, clear, and precise language when discussing their mathematical reasoning.
7. Use appropriate patterns, rules, and operations in order to adequately model and solve problem situations with real world contexts addressing social justice issues in local and global communities.
8. Use algorithms and the reasoning underlying those algorithms to make generalizations about recurring patterns, sharing with others the mathematical knowledge that relates the beauty, harmony, proportion, radiance, and wholeness present in those patterns.
9. Show interest and a sense of wonder in the pursuit of understanding mathematics for its own sake and as a way to enact change and justice in the world, with an understanding that there are limitations to humanity's ability to fully comprehend all mathematical knowledge, drawing on the rich Catholic intellectual tradition and history of mathematical inquiry.
10. Exhibit joy while solving difficult mathematical problems found in creation and in community, while also recognizing the importance of inquiry and learning through mathematical processes.

Content, Knowledge, and Skills Standards

Number System

1. Understand the difference between rational and irrational numbers.
2. Approximate irrational numbers using rational numbers.

Expressions and Equations

3. Work with and understand the use of radicals and integer exponents.
4. Use square root and cube root symbols to represent solutions to equations.

5. Perform operations with numbers expressed in scientific notation.
6. Graph proportional relationships, interpreting the unit rate as the slope of the graph; compare two different proportional relationships graphically represented in different ways.
7. Use the equation for slope to determine points on a plane or determine slope using two points on a plane.
8. Solve linear equations in one variable, including equations with rational number coefficients.
9. Solve real-world and mathematical problems leading to two linear equations in two variables.

Functions

10. Define, evaluate, and compare functions, including their linear and graphical representations (e.g., slope).
11. Construct a function to model a linear relationship between two numbers or quantities.
12. Determine the rate of change and initial value of a function based on the relationship between two functions.
13. Describe qualitatively the functional relationship between two quantities by analyzing a graph; be able to graph a function based on a qualitative description.

Geometry

14. Understand congruence and similarity using physical models, transparencies, or geometry software to analyze lines, angles, and figures.
15. Understand and apply the Pythagorean Theorem and its converse to determine unknown side lengths.
16. Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres.

Statistics and Probability

17. Investigate patterns of association in bivariate data.
18. Construct and interpret scatter plots for bivariate measurement data.
19. Understand how linear associations represent data in scatter plots.
20. Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept.
21. Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table.
22. Construct and interpret a two-way frequency table summarizing data on two categorical variables collected from the same subjects.

Algebra I

Intellectual and Dispositional Standards

1. Solve mathematical problems that emerge from creation and our communities through the use of algebraic and geometric models in order to explain how finding mathematical solutions to these problem situations allows us to more clearly perceive our reality (informed by one's identity, culture, context, beliefs, values, and potential biases).
2. Use mathematical expressions, equations, and inequalities as a way to represent a wide variety of problem situations with real world contexts addressing social justice issues in local and global communities, and compare those mathematical representations to other disciplinary approaches to those problem situations (e.g., theologically, philosophically).
3. Model problem situations symbolically, graphically, tabularly, and contextually while exhibiting both an appreciation for the ability to find meaning in the process of solving those problems and an openness to the idea that mathematical inquiry's infinite nature cannot be limited by those models.
4. Use any and all available mathematical tools when modeling and solving problem situations based on their usefulness to the context of the problem situation.
5. Construct and critique mathematical arguments using verbal or written explanations accompanied by expressions, equations, inequalities, models, graphs, tables, and data displays.
6. Use developmentally appropriate, clear, and precise language when discussing their mathematical reasoning.
7. Use appropriate patterns, rules, and operations in order to adequately model and solve problem situations with real world contexts addressing social justice issues in local and global communities.
8. Use algorithms and the reasoning underlying those algorithms to make generalizations about recurring patterns, sharing with others the mathematical knowledge that relates the beauty, harmony, proportion, radiance, and wholeness present in those patterns.
9. Show interest and a sense of wonder in the pursuit of understanding mathematics for its own sake and as a way to enact change and justice in the world, with an understanding that there are limitations to humanity's ability to fully comprehend all mathematical knowledge, drawing on the rich Catholic intellectual tradition and history of mathematical inquiry.
10. Exhibit joy while solving difficult mathematical problems found in creation and in community, while also recognizing the importance of inquiry and learning through mathematical processes.

Content, Knowledge, and Skills Standards

Number and Quantity

1. Explain how knowledge of integer exponents (e.g., 5^3) can be used to understand exponents with all rational numbers (e.g., $5^{1/3}$).
2. Demonstrate the ability to rewrite expressions containing radicals as expressions containing exponents and vice versa.
3. Explain key properties of arithmetic expressions containing rational and irrational numbers (e.g., that the sum or product of two rational numbers is rational, that the sum of

a rational number and an irrational number is irrational, that the product of a nonzero rational number and an irrational number is irrational).

4. Use units correctly and consistently in understanding problems, solving multi-step problems, choosing accurate scales, and interpreting data/graphs.

Algebra

5. Explain the meaning of the following parts of linear, quadratic, and exponential expressions: terms, factors, coefficients.
6. Write expressions in equivalent forms in order to transform expressions and solve problems related to those expressions.
7. Demonstrate an ability to factor polynomial expressions and quadratic expressions/functions.
8. Conduct the following operations on quadratic expressions: complete the square; reveal the zeros of the function defined by the quadratic expression.
9. Conduct arithmetic operations (addition, subtraction, multiplication) on polynomial expressions.
10. Create equations and inequalities with one or more variables that represent relationships between/among quantities in order to solve problems.
11. Solve and explain the reasoning behind the solutions to linear equations/inequalities and quadratic equations in one variable.
12. Solve and explain the reasoning behind the solutions to systems of equations with the following properties: pairs of linear equations in two variables, simple system containing one linear and one quadratic equation in two variables, systems of two equations in two variables.
13. Represent using graphs (or other visual representation) the following items: relationships between/among quantities defined by equations and inequalities; systems of equations and their solutions.

Functions

14. Explain the following concepts related to functions: the definition of a function and correct function notation; the constituent parts of a function (e.g., domain, range); the fact that functions can be used to represent real-life models.
15. Identify the intercepts, intervals, maximum value, minimum value, and rates of change of linear, quadratic, and exponential functions.
16. Write linear, quadratic, and exponential functions that describe relationships between two quantities.
17. Represent using graphs the following attributes of linear, quadratic, and exponential functions: intercepts, maxima, minima, and end behavior (for exponential functions).
18. Compare and contrast the attributes of different functions, including functions represented in different ways (e.g., one function represented graphically and one function represented as a written expression).
19. Identify the algebraic and graphical qualities of new functions resulting from changes made to existing functions (e.g., when finding a function's inverse, when replacing a function expression $f(x)$ with the expression $f(x)+k$, $k*f(x)$, $f(k*x)$, or $f(x+k)$).
20. Construct models composed of linear, quadratic, and exponential functions in order to solve problems.

21. Determine the most appropriate function forms (linear, quadratic, exponential) for a model based on the relationships the model is intended to represent.

Statistics and Probability

22. Distinguish between correlation and causation.
23. Create with the assistance of technology the following statistical items using appropriate data sets: correlation coefficient, line of best fit (linear), dot plots, histograms, box plots, two-way frequency tables.
24. Compare median, mean, range, and standard deviation for two or more data sets.
25. Demonstrate an ability to represent and interpret data culled from categorical/quantitative variables and single count/measurement variables.