

MATHEMATICS CURRICULUM

PHILOSOPHY

The Mathematics Curriculum Objectives outline the essential components of the Math curriculum for each grade level (K-8) for Diocese of Arlington Catholic Schools. Additionally, the overall academic, personal, spiritual and physical development of the child is an integral part of these objectives.

At each grade level, students are expected to recognize and make meaningful connections with the seven Principles of Catholic Social Teaching: *Life and Dignity of the Human Person; Call to Family, Community, and Participation; Rights and Responsibilities; Option for the Poor and Vulnerable; Dignity of Work and the Rights of Workers; Solidarity; Care for God's Creation*. The incorporation of these principles at each grade-level curriculum is accomplished by references to them throughout the school year in word problems, cooperative learning tasks, and teacher commentary, thereby providing our students with additional contexts for developing a deep appreciation for them.

Mathematics is recognized as a great example of the expansion of God's gift of the human mind for the betterment of all mankind. In today's global society, we are challenged to fully understand and expand mathematical accomplishments to assure a peaceful, productive and more equitable world. Everyday lives are increasingly mathematical and technological. Understanding and applying quantitative skills and solving real-life problems are essential educational goals for all students, regardless of heritage, language, aptitude, talents, needs, or interests. Therefore, all students must be given the opportunity to learn and understand mathematical concepts. Teaching strategies and learning experiences must be varied, meaningful and engaging to students.

In our increasingly technological world, students need to be exposed to and know how to correctly use new tools, communication media and technology to solve cross-curricular mathematical problems. Technology, however, should not be a substitute for the understanding of concepts. Mastery of computational skills should be accomplished at the appropriate grade level as outlined in these objectives. Development of critical thinking, reasoning, and problem-solving skills is recommended in accordance with age-appropriate development of such higher-level thinking skills. It is through communication and collaboration that we will advance our students towards a deeper appreciation and knowledge of mathematics.

KINDERGARTEN

OVERVIEW

The kindergarten math curriculum provides the initial building blocks with the focus on developmental readiness. Emphasis is placed on the following skills:

- developing the concept of number by counting;
- combining, sorting, and comparing sets of objects;
- recognizing and describing simple repeating patterns;
- recognizing shapes and sizes of figures and objects;
- investigating nonstandard measurement, collecting data, and creating graphs.

Problem solving is integrated throughout the content strands. The development of problem-solving skills is a major goal of the mathematics program at every grade level. Instruction in the process of problem solving, which should include problems involving Catholic Social Teaching, not just textbook word problems, will need to be integrated early and continuously into each student's mathematics education. Students must be helped to develop a wide range of skills and strategies for solving a variety of problem types.

- M.K.1 The student will apply the following strategies to solve real-life problems:
- a. Trial and error;
 - b. Picture or object graphs;
 - c. Diagrams;
 - d. Patterns;
 - e. Role playing;
 - f. Use manipulatives;
 - g. Story telling.
- M.K.2 The student will explain answers.
- M.K.3 The student will recognize the use of the calculator.
- M.K.4 The student will problem solve in each math area as well as in other curriculum areas.
- M.K.5 The student will create his/her own problems from every-day situations.
- M.K.6 The student will relate physical materials, pictures, and diagrams to mathematical ideas.
- M.K.7 The student will express mathematical ideas orally and in writing.
- M.K.8 The student will recognize and write numerals 1 to 31
- M.K.9 The student will count numbers:
- a. Count to 50;
 - b. Count backwards from 10.
- M.K.10 The student will identify ordinals to fifth.
- M.K.11 The student will match in one-to-one correspondence.
- M.K.12 The student will recognize sets through 31 and identify corresponding numerals.
- M.K.13 The student will compare sets of objects (more, fewer, and equal).

- M.K.14 The student will recognize one-half.
- M.K.15 The student will indicate the ordered position of three objects and/or pictures from left-to-right, top-to-bottom, and/or bottom-to-top.
- M.K.16 The student will recognize zero quantity.
- M.K.17 The student will name the number of a new set after two sets are joined.
- M.K.18 The student will understand and use the concept of estimation.
- M.K.19 The student will add and subtract whole numbers using up to ten concrete objects.
- M.K.20 The student will select a reasonable magnitude given a 1-digit numeral, a 2-digit numeral, and a 3-digit numeral (e.g. 5, 50, and 500) and explain reasonableness of choice.
- M.K.21 The student will collect, organize, and describe data by counting and tallying.
- M.K.22 The student will read and interpret displays of data (bar graphs, pictographs and tables).
- M.K.23 The student will understand the concept of chance (i.e. by investigating and describing the results of dropping a two-colored counter or using a multi-colored spinner).
- M.K.24 The student will identify, describe, and draw rectangles, squares, triangles, circles and ovals.
- M.K.25 The student will connect line segments to form basic figures using numbers up to 31.
- M.K.26 The student will understand and use directional words (over-under, above-below, before-after, and between).
- M.K.26a The student will explore meaning of inside and outside.
- M.K.27 The student will recognize the concept of time for hour and half-hour using analog and digital clock.
- M.K.28 The student will locate numbers on calendar (day, month, and year).
- M.K.28a The student will name and sequence the days of the week and the months of the year.
- M.K.29 The student will recognize penny, nickel, dime, and quarter from either side of the coins.
- M.K.30 The student will utilize coins to develop counting skills and money awareness.
- M.K.31 The student will compare lengths and heights (long, short, and tall), using ruler.
- M.K.32 The student will compare weight (light and heavy), using scale and balances.
- M.K.33 The student will recognize the use of the thermometer to measure and compare temperatures.
- M.K.34 The student will sort and classify objects according to similar attributes (size, shape, color).
- M.K.35 The student will identify, describe, and extend a repeating relationship (pattern) found in common objects, sounds, and movements.

GRADE ONE

OVERVIEW

The first-grade math curriculum is based on skills introduced in kindergarten, which will spiral to the second grade. Emphasis is placed on the following skills:

- counting, sorting, and comparing sets of up to 100 objects;
- recognizing and describing simple repeating and growing patterns;
- drawing, sorting, and describing certain two-dimensional figures;
- applying the basic addition facts through the fives table;
- applying the corresponding subtraction facts;
- using nonstandard units to measure;
- organizing and interpreting data;
- recognizing fractions.

Problem solving is integrated throughout the content strands. The development of problem-solving skills is a major goal of the mathematics program at every grade level. Instruction in the process of problem solving, which should include problems involving Catholic Social Teaching, not just textbook word problems, will need to be integrated early and continuously into each student's mathematics education. Students must be helped to develop a wide range of skills and strategies for solving a variety of problem types.

- M.1.1 The student will apply the following strategies to solve real-life problems:
- a. Trial and error;
 - b. Lists and tables;
 - c. Diagrams;
 - d. Patterns;
 - e. Role playing;
 - f. Guess and test;
 - g. Use manipulatives;
 - h. Simplify the problem;
 - i. Write an equation/number sentence.
- M.1.2 The student will explain and justify answers.
- M.1.3 The student will understand the use of the calculator and computer for appropriate activities.
- M.1.4 The student will problem solve in each math area as well as other curriculum areas.
- M.1.5 The student will create his/her own problems from every-day situations.
- M.1.6 The student will relate physical materials, pictures, and diagrams to mathematical ideas.
- M.1.7 The student will express mathematical ideas orally and in writing.
- M.1.8 The student will relate every-day language to mathematical language and symbols.
- M.1.9 The student will recognize and write numerals 0 through 100.
- M.1.10 The student will identify number words from zero through twenty.
- M.1.11 The student will count by 2s, 5s, and 10s, to 100.

- M.1.12 The student will identify ordinal positions, first through tenth, using an ordered set of objects.
- M.1.13 The student will compare numbers using greater than, less than, equal to.
- M.1.14 The student will identify equivalent and non-equivalent sets.
- M.1.15 The student will count objects in a given set containing between ten and one hundred objects, and name the corresponding numeral.
- M.1.16 The student will identify and represent concepts of one-fourth, one-third, and one half, using appropriate materials or a drawing.
- M.1.17 The student will identify numbers before, after and between, to 100.
- M.1.18 The student will recognize zero quantity and use in number sentences.
- M.1.19 The student will count a group of pennies, nickels, dimes, and quarters with total value of \$1.00 or less.
- M.1.20 The student will understand the basic relationship between addition and subtraction.
- M.1.21 The student will group concrete objects by ones and tens to develop the idea of place value.
- M.1.22 The student will recognize place value through hundreds.
- M.1.23 The student will master basic facts, sums to 12 or less, and the corresponding subtraction facts.
- M.1.24 The student will use manipulatives to show addition and subtraction problems through 10.
- M.1.25 The student will add and subtract 2-digit numbers, no regrouping.
- M.1.26 The student will add three addends, sums to 10.
- M.1.27 The student will use horizontal and vertical notation.
- M.1.28 The student will rename numbers by addition or subtraction.
- M.1.29 The student will understand the concept of missing numerals in addition and subtraction problems having sums or differences no greater than 9.
- M.1.30 The student will solve one-step story and picture problems using basic addition and subtraction facts.
- M.1.31 The student will use estimation with quantities, measurement, and problem solving.
- M.1.32 The student will investigate, identify, and describe various forms of data collection in real world (e.g. recording daily temperature, lunch count, attendance, favorite foods).
- M.1.33 The student will create and interpret line graphs, bar graphs, pictographs.

- M.1.34 The student will interpret information displayed in a picture or object graph using vocabulary: more, less, fewer, greater than, less than.
- M.1.35 The student will understand the concept of chance, at a rudimentary level.
- M.1.36 The student will draw and describe triangles, squares, rectangles, and circles according to number of sides, sides with the same length, corners, and square corners.
- M.1.36a The student will identify and describe objects in the environment that depict geometric figures (triangle, rectangle, square, and circle).
- M.1.36b The student will identify geometric solids (pyramid, sphere, cone, cylinder, cube, rectangular solid).
- M.1.36c The student will recognize symmetry in two-dimensional objects.
- M.1.37 The student will connect line segments to form basic figures using numbers up to 100.
- M.1.38 The student will describe the proximity of objects in space (near, far, close by, below, up, down, beside, next to).
- M.1.39 The student will tell time by hour, half-hour, using an analog or digital clock.
- M.1.40 The student will identify days, weeks, months on calendar.
- M.1.41 The student will identify number of pennies equivalent to a nickel, a dime, and a quarter.
- M.1.42 The student will count collections of coins up to \$1.00 and compare value.
- M.1.43 The student will use standard and nonstandard units to measure length.
- M.1.44 The student will use standard and nonstandard units to measure weight.
- M.1.45 The student will measure temperature in degrees Fahrenheit.
- M.1.46 The student will: measure length to the nearest inch and nearest centimeter; and measure volume capacity to the nearest pint, quart, liter.
- M.1.47 The student will compare the volume capacities of two given containers by using concrete materials (e.g. jelly beans, sand, water, rice).
- M.1.48 The student will compare the weight of two objects using a balance scale.
- M.1.49 The student will sort and classify concrete objects according to one or more attributes, including color, size, shape, and thickness.
- M.1.50 The student will recognize, describe, extend, and create various patterns, including rhythmic, color, shape and numeric, using concrete materials.

GRADE TWO

OVERVIEW

The second-grade math curriculum is based on the skills introduced in kindergarten, developed and expanded in first grade, which spiral to the third grade level. Emphasis is placed on the following skills:

- extending the study of number and spatial sense to include three-digit numbers and three-dimensional figures;
- continuing to learn, use, and gain proficiency in the basic addition facts through the nines table and the corresponding subtraction facts;
- using standard U.S. Customary and metric units of measurement;
- predicting and using simple probability;
- creating and interpreting picture and bar graphs;
- working with a variety of patterns;
- developing knowledge of equality by identifying missing numbers in addition and subtraction facts.

Problem solving is integrated throughout the content strands. The development of problem-solving skills is a major goal of the mathematics program at every grade level. Instruction in the process of problem solving, which should include problems involving Catholic Social Teaching, not just textbook word problems, will need to be integrated early and continuously into each student's mathematics education. Students must be helped to develop a wide range of skills and strategies for solving a variety of problem types.

- M.2.1 The student will apply the following strategies to solve real-life problems:
- a. Trial and error;
 - b. List or tables;
 - c. Diagrams;
 - d. Patterns;
 - e. Role playing;
 - f. Guess and test;
 - g. Use manipulatives;
 - h. Simplify the problem;
 - i. Write an equation.
- M.2.2 The student will explain and justify answers.
- M.2.3 The student will use the calculator and computer for appropriate activities.
- M.2.4 The student will problem solve in each math area as well as in other curriculum areas.
- M.2.5 The student will create his/her own problems from every-day situations.
- M.2.6 The student will relate physical materials, pictures, and diagrams to mathematical ideas.
- M.2.7 The student will express mathematical ideas orally and in writing.
- M.2.8 The student will relate every-day language to mathematical language and symbols.
- M.2.9 The student will read, write, and understand the magnitude of numbers through 1,000.

- M.2.10 The student will skip count by 2s, 3s, 4s, 5s, and 10s up to 100.
- M.2.11 The students will read and understand the meaning of ordinal numbers to 50th.
- M.2.12 The student will compare two whole numbers using symbols (“>”, “<”, “=”), and words (“greater than”, “less than”, or “equal to”).
- M.2.13 The student will identify part of a set and/or region that represents $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, $\frac{1}{8}$, $\frac{1}{10}$, and write the corresponding fraction. The student will divide shapes into fractional parts ($\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, $\frac{1}{8}$, $\frac{1}{10}$).
- M.2.14 The student will identify the place value of each digit in a 3-digit numeral, using numeration models.
- M.2.15 The student will recognize odd and even numbers.
- M.2.16 The student will recognize number patterns in sequence.
- M.2.17 The student will estimate the sum of two whole numbers, each 99 or less.
- M.2.18 The student will estimate the difference between two whole numbers, each 99 or less.
- M.2.19 The student will master basic addition facts, sums to 20 or less, and the corresponding subtraction facts.
- M.2.20 The student will add and subtract multiples of 100.
- M.2.21 The student will solve addition and subtraction problems using data from simple charts and picture graphs. Problems will require a one-step solution.
- M.2.22 The student will be given a simple addition or subtraction fact, recognize and describe the inverse relationship between addition and subtraction (e.g.: $3 + _ = 7$; $_ + 3 = 7$; $7 - 3 = _$; $7 - _ = 3$) to check addition and subtraction problems.
- M.2.23 The student will solve addition equations with three or more addends for sums to 20.
- M.2.24 The student will find the sum of two whole numbers, each 99 or less, using various methods of calculation (mental computation, concrete materials, and paper and pencil). Problems involve both regrouping and no regrouping.
- M.2.25 The student will find the difference between two whole numbers, each 99 or less, using various methods of calculation (mental computation, concrete materials, and paper and pencil). Problems involve both regrouping and no regrouping.
- M.2.26 The student will understand and apply zero property of addition.
- M.2.27 The student will count, compare, and make change, using a collection of coins and one-dollar bills.
- M.2.28 The student will identify the correct usage of the cent symbol (¢), dollar symbol (\$), and decimal point.
- M.2.29 The student will show multiplication by joining equivalent sets.
- M.2.30 The student will relate addition to multiplication, and subtraction to division.

- M.2.31 The student will multiply by 2, 3, 4, and 5, products to 25.
- M.2.32 The student will read, construct, and interpret displays of data (bar graphs, pictographs, line graphs and tables).
- M.2.33 The student will explore and record concepts of chance using spinners and colored tiles/cubes, and use the data to predict which of two events is more likely to occur if the experiment is repeated.
- M.2.34 The student will identify and describe a cube, rectangular solid, sphere, cylinder, pyramid, and cone, according to the number and shape of faces, edges, bases, and corners by using models and/or geoboards.
- M.2.34a The student will compare and contrast plane and solid geometric shapes (circle/sphere, square/cube, triangle/pyramid, and rectangle/rectangular solid) by using models and/or geoboards.
- M.2.35 The student will identify and create symmetrical figures, using various concrete materials.
- M.2.36 The student will demonstrate, using concrete models, how an object can slide, flip, or turn.
- M.2.37 The student will tell time to five-minute intervals using analog and digital clocks.
- M.2.38 The student will determine past and future days of the week and identify specific dates on a calendar.
- M.2.39 The student will estimate and then use a ruler to make linear measurements to the nearest centimeter, meter, inch, and foot, including the distance around a polygon (determine perimeter).
- M.2.40 The student will estimate and then determine weight of familiar objects in pounds, using a scale, and will estimate and then determine mass of familiar objects in grams and kilograms, using a balance.
- M.2.41 The student will estimate and count the number of cubes in a rectangular box (determine volume).
- M.2.42 The student will use actual measuring devices to compare metric and U. S. customary units (cups, pints, quarts, gallons, and liters) for measuring liquid volume, using the concepts of more, less, and equivalent.
- M.2.43 The student will measure temperature in degrees Fahrenheit and degrees Celsius.
- M.2.44 The student will use grid paper to estimate, and then count, the number of square units needed to cover a given surface (determine area).
- M.2.45 The student will complete a sequence of ten or fewer consecutive whole numbers, 0 through 999, counting both forwards and backwards.
- M.2.46 The student will identify, create, and extend a wide variety of patterns, using symbols and objects.

M.2.47

The student will solve problems by completing a numerical sentence involving the basic facts for addition and subtraction. Examples include: $3 + \underline{\quad} = 7$; or $9 - \underline{\quad} = 2$. Students will create story problems using the numerical sentences.

GRADE THREE

OVERVIEW

The third grade Math curriculum encompasses several essential foundation-building skills that are prerequisite to the fourth grade curriculum. Students entering third grade are expected to have mastered basic addition and subtraction facts, as well as addition and subtraction with regrouping. Rising third graders should understand the basic concept of multiplication and division. Key among third grade math skills and concepts are:

- Reading and writing decimals expressed as tenths and hundredths;
- Comparing two fractions with like or unlike denominators using concrete materials;
- **Mastering** multiplication and division facts for products and dividends through 144, and recognizing the correct operational signs for each operation;
- Multiplying three single-digit factors with products up to 144;
- Multiplying 1, 2, 3, and 4-digit factors by 1-digit factors, with and without regrouping;
- Computing long division problems with 1-digit divisors;
- Adding and subtracting proper fractions with like denominators of 10 or less;
- Adding and subtracting decimals expressed as tenths;
- Using circle graphs and Venn diagrams in addition to pictographs, bar graphs, and line graphs to collect, organize, read, and interpret data;
- Identifying, drawing and labeling points, lines, line segments, angles, and diagonals, using a ruler or straight edge.

Throughout the curriculum, students should be using problem solving strategies to solve real-life problems for each concept learned. Problem solving should also include problems involving Catholic Social Teaching, not just textbook word problems. Third grade vocabulary should also be learned for each concept. Some of the vocabulary is new to third grade. The following guidelines give a detailed outline of objectives for the third grade.

- M.3.1 The student will apply the following strategies to solve real-life problems:
- a. Trial and error;
 - b. Lists or tables;
 - c. Diagrams;
 - d. Patterns;
 - e. Role playing;
 - f. Guess and test;
 - g. Use manipulatives;
 - h. Simplify the problem;
 - i. Write an equation;
 - j. Work backwards.
- M.3.2 The student will explain and justify answers.
- M.3.3 The student will use calculators and computers to solve problems focusing on process rather than calculations.
- M.3.4 The student will problem solve in each math area as well as in other curriculum areas.

- M.3.5 The student will create his/her own problems from every-day situations.
- M.3.6 The student will relate physical materials, pictures, and diagrams to mathematical ideas.
- M.3.7 The student will express mathematical ideas orally and in writing.
- M.3.8 The student will relate every-day language to mathematical language and symbols.
- M.3.9 The student will read and write 6-digit numerals and identify the place value of each digit.
- M.3.10 The student will explore and predict number patterns.
- M.3.11 The student will round 2 and 3-digit numbers to the nearest ten, and round 3-digit numbers to the nearest hundred and nearest thousand.
- M.3.12 The student will compare whole numbers through hundred thousands utilizing symbols “>”, “<”, “=” and words “greater than”, “less than”, and “equal to”.
- M.3.13 The student will understand how basic arithmetic operations are related to one another.
- M.3.14 The student will recognize and use the inverse relationships of addition/subtraction and multiplication/division to complete basic fact sentences.
- M.3.15 The student will read, identify and write fractions and mixed numbers.
- M.3.16 The student will compare the numerical value of two fractions having like and unlike denominators, using concrete materials.
- M.3.17 The student will read and write decimals expressed as tenths and hundredths using concrete materials.
- M.3.18 The student will use 0 as a placeholder.
- M.3.19 The student will find the sums and differences of two whole numbers (9,999 or less), with and without regrouping, using paper and pencil, estimation, and mental computation. Calculators are to be used, at times, to check answers.
- M.3.20 The student will solve addition equations with three or more addends.
- M.3.20a The student will identify and investigate the identity and the commutative properties for addition and multiplication.
- M.3.21 The student will master multiplication and related division facts for products and dividends through 144.
- M.3.22 The student will define and use the terms: factor; product; dividend; divisor; and quotient.
- M.3.23 The student will multiply three 1-digit numbers, with products up to 144.
- M.3.24 The student will multiply 1, 2, 3, and 4-digit factors by 1-digit factors, with and without regrouping.
- M.3.25 The student will divide 1, 2, 3, and 4-digit dividends by 1-digit divisors, with and without remainders.

- M.3.26 The student will use word clues to determine which of the four operations to use in problem solving.
- M.3.27 The student will use estimation strategies by rounding to nearest ten, hundred, and thousand.
- M.3.28 The student will determine, by counting, the value of a group of bills and coins up to five dollars, compare the value of coins and bills, and make change.
- M.3.29 The student will correctly express monetary values using cent (¢), dollar (\$), and decimal points.
- M.3.30 The student will make mental computation and use estimation for all four operations.
- M.3.31 The student will use estimation with quantities, measurements, computation, and problem solving.
- M.3.32 The student will add and subtract with proper fractions having like denominators of 12 or less, using concrete materials, and paper and pencil.
- M.3.33 The student will add and subtract with decimals expressed as tenths, using concrete materials and paper and pencil.
- M.3.34 The student will construct, collect, organize, read and interpret data represented on:
 ___ pictographs;
 ___ bar graphs;
 ___ line graphs;
 ___ tables;
 ___ circle graphs;
 ___ Venn diagrams.
- M.3.35 The student will investigate and explore the concept of probability as chance, listing possible outcomes of a given situation.
- M.3.36 The student will recognize and describe plane and solid geometric figures (square, rectangle, triangle, cube, rectangular solid, cone, sphere, and cylinder), using identifying properties (number of corners, square corners, number and shape of faces, number of edges and vertices).
- M.3.37 The student will identify, draw, and label points, lines, line segments, angles, rays and diagonals, using a ruler or straightedge.
- M.3.38 The student will, given appropriate drawings or models, identify and describe congruent and symmetrical two-dimensional figures, using tracing procedures.
- M.3.39 The student will use concrete materials to predict and describe the results of sliding, flipping, and turning two-dimensional objects.
- M.3.40 The student will measure:
 ___ length ($\frac{1}{2}$ inch, inches, feet, yards, centimeters, and meters);
 ___ area and perimeter
 ___ capacity (cups, pints, quarts, gallons, and liters);
 ___ weight (ounces, pounds);
 ___ mass (grams and kilograms); and
 ___ temperature (degrees Fahrenheit and degrees Celsius).

- M.3.41 The student will order (least to greatest and greatest to least) customary and metric units for length, capacity, volume, and weight.
- M.3.42 The student will tell time to one-minute intervals using both analog and digital clocks.
- M.3.43 The student will identify equivalent periods of time, including relationships among days, weeks, months, and years, as well as between minutes, hours, and fractions of an hour.
- M.3.44 The student will calculate elapsed time, expressed in hours and minutes.
- M.3.45 The student will identify and locate missing whole numbers on a number line.
- M.3.46 The student will recognize, describe, and extend patterns formed using concrete materials, tables, and pictures.
- M.3.47 The student will analyze a given pattern formed using concrete objects and pictures, and then create a pattern with the same attributes.

GRADE FOUR

OVERVIEW

The fourth grade Math curriculum encompasses several essential foundation-building skills that are prerequisite to the fifth grade curriculum. Students entering fourth grade are expected to have mastered basic multiplication and division facts as well as addition and subtraction with regrouping. Key fourth-grade concepts to be taught are:

- Identifying place value through millions;
- Computing multiple-digit multiplication problems;
- Understanding and correctly using the terms: “prime”, “composite”, “factor”, “multiple”, and “compatible”;
- Computing long division problems with two-digit divisors;
- Using rules of divisibility by 2, 3, 5, and 10;
- Estimating by rounding and using compatible numbers;
- Multiplying and dividing mentally by 10, 100, and 1,000;
- Computing simple averages (or means);
- Identifying prime and composite numbers, and multiples of a given factor;
- Finding the least common denominator for the comparison, addition and subtraction of fractions;
- Relating fractions to decimal equivalents, and correctly reading, writing, and interpreting decimals through thousandths;
- Expanding the understanding and application of graphs to include circle graphs as well as bar graphs, line graphs, pictographs and Venn diagrams previously explored;
- Expanding the understanding of three-dimensional figures, lines, segments, points, rays, coordinates, and planes;
- Recognizing and identifying parallel, perpendicular, and intersecting lines;
- Recognizing properties of quadrilaterals and regular polygons;
- Expanding on the measurement of lengths, capacity, weight, and temperature, using both customary and metric units and measurements of time;
- Converting measurement within a measurement system;
- Making “ballpark” comparisons between metric and customary measurements;
- Expanding the understanding and usage of variables and algebraic patterns.

Throughout the curriculum, students should be using problem solving strategies to solve real-life problems for each concept learned. Problem solving should also include problems involving Catholic Social Teaching, not just textbook word problems. Fourth-grade vocabulary should also be learned for each concept. Some of the vocabulary is new to fourth grade. Students are expected to know and use the correct mathematical language by this grade level. The following guidelines give a detailed outline of objectives for the fourth grade.

M.4.1

The student will apply the following strategies to solve real-life problems:

- a. Trial and error;
- b. Lists or tables;
- c. Diagrams;
- d. Patterns;
- e. Role playing;
- f. Guess and test;
- g. Use manipulatives;
- h. Simplify the problem;
- i. Write an equation;
- j. Work backwards.

- M.4.2 The student will explain and justify answers.
- M.4.3 The student will understand the use of the calculator and computer for appropriate problem-solving activities.
- M.4.4 The student will problem solve in each math area as well as in other curriculum areas.
- M.4.5 The student will create his/her own problems from every-day situations.
- M.4.6 The student will relate physical materials, pictures, and diagrams to mathematical ideas.
- M.4.7 The student will express mathematical ideas orally and in writing.
- M.4.8 The student will relate every-day language to mathematical language and symbols.
- M.4.9 The student will expand number and operation sense, including an understanding of place value through millions, and read and write numbers through millions in standard and expanded form.
- M.4.10 N/A
- M.4.11 The student will round whole numbers expressed through millions to the nearest thousand, ten thousand, and hundred thousand.
- M.4.12 The student will compare whole numbers, expressed through millions.
- M.4.13 The student will understand how basic arithmetic operations are related to one another.
- M.4.14 The student will recognize and use properties of an operation (commutative, associative, zero, identity).
- M.4.15 The student will understand and correctly use the terms: prime, composite, factor, and multiple.
- M.4.16 The student will use rules of divisibility by 2, 3, 5, and 10.
- M.4.17 The student will develop an awareness of the relative size of fractions having denominators of 12 or less.
- M.4.18 The student will recognize, identify, and represent equivalent fractions.
- M.4.19 The student will relate fractions to decimals using concrete objects.
- M.4.20 The student will read, write, represent, identify, compare and order decimals expressed through thousandths and round them to the nearest whole number, nearest tenth, and nearest hundredth.
- M.4.21 The student will use 0 as a placeholder.
- M.4.22 The student will read and write roman numerals through 3,000 using symbols: I, V, X, L, C, D, M.
- M.4.23 The student will maintain and expand skills of addition and subtraction to include adding and subtracting 5 and 6-digit numbers, with and without regrouping.

- M.4.24 The student will maintain mastery of basic multiplication and division facts and the ability to multiply 3 and 4-digit numbers by 1-digit numbers, with and without regrouping.
- M.4.25 The student will multiply 3-digit numbers by 2-digit numbers, with and without regrouping.
- M.4.26 The student will multiply 3-digit numbers by 3-digit numbers.
- M.4.27 The student will multiply and divide by 10, 100, and 1,000, mentally.
- M.4.28 The student will divide 2, 3, and 4-digit dividends by 2-digit divisors.
- M.4.29 The student will divide by 2 and 3-digit divisors, with 0 in the quotients.
- M.4.30 The student will add, subtract, multiply, and divide dollars and cents.
- M.4.31 The student will find the greatest common factor, least common multiple, and least common denominator.
- M.4.32 The student will add and subtract fractions with like and unlike denominators of 12 or less, and decimals through thousandths.
- M.4.33 The student will explore estimation strategies, and use them in all four operations.
- M.4.34. The student will develop a range of good estimates which determine the reasonableness of results.
- M.4.35 The student will use estimation with quantities, measurement, computation, and problem solving.
- M.4.36 The student will create and solve story problems using computation in all operations.
- M.4.37 The student will make mental computations and use estimation in all four operations.
- M.4.38 The student will identify the division statement that represents a fraction.
- M.4.39 The student will construct, collect, organize, read, and interpret data represented on:
 ___ pictographs;
 ___ bar graphs;
 ___ line graphs;
 ___ circle graphs;
 ___ Venn diagrams.
- M.4.40 The student will investigate and explore the concept of probability as chance, listing possible outcomes of a given situation.
- M.4.41 The student will compute simple averages.
- M.4.42 The student will recognize and identify three-dimensional figures, including prisms, pyramids, cylinders, cones, spheres, rectangular prisms, triangular prisms, and cubes.
- M.4.43 The student will identify and describe the relationship between and among plane, line, line segment, point, ray, and angles including end points and vertices.

- M.4.44 N/A
- M.4.45 The student will use concrete materials to predict and describe the results of sliding, flipping, and turning two-dimensional objects.
- M.4.46 The student will recognize and identify intersecting, parallel, and perpendicular lines.
- M.4.47 The student will recognize properties of quadrilaterals and regular polygons.
- M.4.48 The student will define polygons and identify polygons with 10 and fewer sides.
- M.4.49 The student will recognize congruent and symmetrical figures.
- M.4.50 The student will measure, using customary and metric units:
 ___ length ($\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$ inches; feet; yards; millimeters; centimeters; meters; and kilometers);
 ___ volume (cups, pints, quarts, gallons, milliliters, and liters);
 ___ weight (ounces, pounds, and tons);
 ___ mass (grams and kilograms); and
 ___ temperature (degrees Fahrenheit and degrees Celsius).
- M.4.51 The student will convert measurements within a measurement system (either customary or metric).
- M.4.52 The student will make “ballpark” comparisons between customary and metric measurements. (Students at this level are *not* required to memorize conversion factors between customary and metric measurements.)
- M.4.53 The student will use measurement to explore and describe the environment.
- M.4.54 The student will find the perimeter of polygons, using standard formulas.
- M.4.55 The student will determine and use elapsed time to solve problems.
- M.4.56 The student will identify and locate missing whole numbers on a number line.
- M.4.57 The student will recognize, describe, and extend a given pattern, using concrete materials and tables.
- M.4.58 The student will understand the concept of a variable and solve a simple equation using a variable to represent a missing number in the equation.
- M.4.59 The student will solve problems involving pattern identification and completion of patterns.

GRADE FIVE

OVERVIEW

The fifth grade Math curriculum is based on the skills introduced and mastered in Kindergarten through Fourth grades, which spiral to the Fifth grade level. Added to the maintenance of these skills are:

- Relating decimals to simple percents (10%, 25%, 50%, 75%);
- Comparing and converting among fractions, decimals, and percents;
- Exploring numbers less than zero by extending the number line to include negative integers;
- Multiplying two decimals to the thousandths place;
- Adding and subtracting fractions and mixed numbers, with and without regrouping, and expressing answers in simplest form;
- Multiplying and dividing fractions and mixed numbers;
- Dividing up to four-digit dividends by 1-digit divisors using *short division*;
- Constructing, collecting, organizing, and interpreting data represented on a stem-and-leaf graph;
- Finding and using the mean of a given set of numbers;
- Using probability and ratios to measure the likelihood of events, and recognizing the difference between categorical and numerical data;
- Using approximate measurements to explore and describe the environment, and recognizing how differences in units affect precision;
- Using formulas to find the area and perimeter of rectangles, triangles, and parallelograms, developing strategies to determine the surface areas and volumes of rectangular solids, and exploring what happens to the perimeters and areas of two-dimensional figures when the shapes are changed in some way;
- Identifying and drawing acute, right, obtuse and straight angles;
- Classifying triangles by sides (scalene, isosceles, equilateral) and angles (acute, right, obtuse);
- Identifying and describing the diameter, radius, chord, circumference, and area of a circle;
- Using coordinate systems to specify locations and to describe paths, and finding the distance between points along horizontal and vertical lines in all four quadrants of a coordinate graph;
- Investigating how changes in one variable relate to changes in a second variable, and comparing situations with constant and varying rates of change.

Throughout the curriculum, students should be using problem solving strategies to solve real-life problems for each concept learned. Problem solving should also include problems involving Catholic Social Teaching, not just textbook word problems. Fifth grade vocabulary should also be learned for each concept. Some of the vocabulary is new to fifth grade. Students are expected to know and use the correct mathematical language by this grade level. The following guidelines give a detailed outline of the objectives for fifth grade.

- M.5.1 The student will apply the following strategies to solve problems, including multi-step, non-routine, and real-life problems:
- a. Trial and error;
 - b. Lists or tables;
 - c. Diagrams;
 - d. Patterns;
 - e. Role playing;
 - f. Guess and test;
 - g. Use manipulatives;
 - h. Simplify the problem;
 - i. Write an equation;
 - j. Work backwards.
- M.5.2 The student will verify that a solution is reasonable with respect to the original problem situation.
- M.5.3 The student will understand the use of the calculator and computer for appropriate problem-solving activities.
- M.5.4 The student will problem solve in each math area, as well as in other curriculum areas.
- M.5.5 The student will use mathematics to draw conclusions from concrete situations and to justify mathematical arguments.
- M.5.6 The student will express mathematical ideas in oral, written, pictorial, graphic, and symbolic forms.
- M.5.7 The student will use mathematics to solve problems, make predictions, interpret data, and reach conclusions in all subjects.
- M.5.8 The student will understand the magnitude of whole numbers through millions (reading and writing in word, standard, and expanded form).
- M.5.9 The student will apply the following properties when working with addition and multiplication: commutative; associative; zero; identity; and distributive.
- M.5.10 The student will round whole numbers to the nearest million, and decimals to the nearest thousandth.
- M.5.11 The student will read, write, and identify the place values of decimals, through ten-thousandths.
- M.5.12 The student will relate decimals to percents. (10%, 25%, 50%, 75%)
- M.5.13 The student will compare whole numbers, fractions, decimals, and percents.
- M.5.14 The student will use 0 as a placeholder in decimals.
- M.5.15 Vacant
- M.5.16 The student will read and locate negative integers on a number line.
- M.5.17 The student will understand negative integers through familiar applications such as temperatures below zero, yards lost and gained in football, etc.

- M.5.18 The student will create and solve problems using the order of operations involving addition, subtraction, multiplication, and division of whole numbers and decimals, using paper and pencil, estimation, mental computation, and calculators.
- M.5.19 The student will, given a dividend of four digits or less and a divisor of three digits or less, find the quotient and remainder.
- M.5.20 The student will find the product of two numbers expressed as decimals through thousandths, using an appropriate method of calculation, including paper and pencil, estimation, mental computation, and calculators.
- M.5.21 The student will, given a dividend expressed as a decimal through ten-thousandths and a single-digit divisor, find the quotient.
- M.5.22 The student will find equivalent fractions.
- M.5.23 The student will add and subtract fractions and mixed numbers, with and without regrouping, and express answers in simplest form; problems will include like and unlike denominators.
- M.5.24 The student will multiply and divide fractions and mixed numbers.
- M.5.25 The student will use short division to divide 1, 2, 3, and 4-digit dividends by 1-digit divisors, with and without a remainder.
- M.5.26 The student will construct, collect, organize, read, and interpret data represented on:
 ___ pictographs
 ___ bar graphs
 ___ line graphs
 ___ circle graphs
 ___ Venn diagrams
 ___ stem-and-leaf plots
- M.5.27 The student will investigate and explore the concept of probability as chance, listing possible outcomes of a given situation.
- M.5.28 The student will find and use:
 ___ mean;
 ___ median;
 ___ mode; and
 ___ range.
- M.5.29 The student will make predictions based on experimental data.
- M.5.30 The student will understand that the measure of the likelihood of an event can be represented as a fraction or a decimal.
- M.5.31 The student will recognize, draw and construct three-dimensional geometric figures from two-dimensional representations, or from nets.
- M.5.32 The student will identify, define, and represent points, lines, line segments, rays, angles, and planes.
- M.5.33 The student will identify the ordered pair for a point, and locate the point for an ordered pair in all four quadrants of a coordinate plane.

- M.5.34 The student will depict slides, flips, and turns of an object, using graph paper.
- M.5.35 The student will identify intersecting, perpendicular, and parallel lines.
- M.5.36 The student will identify, measure and draw acute, right, obtuse, and straight angles, using appropriate tools.
- M.5.37 The student will classify triangles by sides (scalene, isosceles, equilateral) and angles (acute, right and obtuse).
- M.5.38 The student will recognize similar, congruent, and symmetrical figures.
- M.5.39 The student will make and use coordinate systems to specify locations and to describe paths.
- M.5.40 The student will find the distance between points along horizontal and vertical lines of a coordinate graph.
- M.5.41 The student will use geometrical figures to solve problems involving numbers and number sense, measurement, and real-life problem-solving situations.
- M.5.42 The student will use appropriate measuring devices and units of measurement (customary and metric) to solve problems involving:
 ___ length (inches, feet, yards, centimeters, and meters);
 ___ capacity (cups, pints, quarts, gallons, and liters);
 ___ weight (ounces, pounds, and tons);
 ___ mass (grams and kilograms); and
 ___ temperature (degrees Fahrenheit and degrees Celsius).
- M.5.43 The student will estimate the conversion of Fahrenheit and Celsius units relative to familiar situations (freezing and boiling points of water, normal body temperature, etc.).
- M.5.44 The student will identify and describe the diameter, radius, chord, circumference, and area of a circle.
- M.5.45 The student will use measurement to explore and describe the environment.
- M.5.46 The student will describe and determine the perimeter of a polygon, and find the area of squares, triangles and rectangles.
- M.5.47 The student will determine and use elapsed time to solve problems.
- M.5.48 The student will understand that measurements are approximations, and how differences in units affect the accuracy of measurements.
- M.5.49 The student will explore what happens to measurements of a two-dimensional figure, such as perimeter and area, when the shape is changed in some way.
- M.5.50 The student will develop strategies for estimating the perimeters, areas, and volumes of irregular shapes.
- M.5.51 The student will develop, understand, and use formulas to find the area of rectangles and related triangles and parallelograms.
- M.5.52 The student will develop strategies to determine the surface area and volume of rectangular solids.

- M.5.53 The student will investigate, describe, and extend numerical and geometric patterns formed by:
 ___ powers of 10;
 ___ perfect squares;
 ___ triangular numbers; and
 ___ arithmetic sequences.
Concrete materials and calculators will be used.
- M.5.54 The student will investigate, describe, and apply the concept of variables.
- M.5.55 The student will use a variable to represent a given verbal quantitative expression, involving one operation.
- M.5.56 The student will solve problems involving pattern identification and completion of patterns.
- M.5.57 The student will write an open sentence with addition, subtraction, multiplication and division, using a variable to represent a missing number.
- M.5.58 The student will create a problem situation, based on a given open sentence using a single variable.
- M.5.59 The student will investigate how changes in one variable affect a second variable.
- M.5.60 The student will identify and describe situations with constant or varying rates of change and compare them.

GRADE SIX

OVERVIEW

The sixth-grade math curriculum is based on the skills introduced and mastered in kindergarten through fifth grades, which will spiral to the sixth-grade level. Significant additions to the maintenance of these skills include:

- Adding, subtracting, multiplying, and dividing decimals;
- Identifying and representing integers on a number line;
- Calculating percentages;
- Using exponents to express powers;
- Generalizing patterns, and expressing them in words and with expressions;
- Relating and comparing data using ratios;
- Finding the areas and perimeters/circumferences of circles, quadrilaterals, and triangles;
- Using a compass to construct line and angle bisectors;
- Solving algebraic expressions with whole number coefficients;
- Converting among decimals, fractions, and percents;
- Analyzing and interpreting data, statistically and graphically.

Problem solving is integrated throughout the content strands. The development of problem-solving skills is a major goal of the mathematics program at every grade level. Instruction in the process of problem solving, which should include problems involving Catholic Social Teaching, not just textbook word problems, will need to be liberally integrated into each student's mathematics education. Students must be helped to develop a wide range of skills and strategies for solving a variety of problem types. Students should learn to present their mathematical ideas in a variety of forms, including the spoken and written word, pictures, drawings, and graphs. Sixth-grade vocabulary should also be emphasized for each concept, as students are expected to know and use correct mathematical language.

- M.6.1 The student will apply the following strategies to solve problems, including multi-step, non-routine, and real-life problems:
- a. Trial and error;
 - b. Lists or tables;
 - c. Diagrams;
 - d. Patterns;
 - e. Role playing;
 - f. Guess and test;
 - g. Use manipulatives;
 - h. Simplify the problem;
 - i. Write an equation;
 - j. Work backwards.
- M.6.2 The student will verify that a solution is reasonable with respect to the original problem situation.
- M.6.3 The student will understand the use of the calculator and computer for appropriate problem-solving activities.
- M.6.4 The student will problem solve in each math area as well as in other curriculum areas.

- M.6.5 The student will use mathematics to draw conclusions from concrete situations and to justify mathematical arguments.
- M.6.6 The student will express mathematical ideas in oral, written, pictorial, graphic, and symbolic forms.
- M.6.7 The student will use mathematics to solve problems, make predictions, interpret data, and reach conclusions in all subjects.
- M.6.8 The student will identify representations of a given percent and describe orally and in writing the equivalence relationship among fractions, decimals, and percents.
- M.6.9 The student will describe and compare two sets of data using ratios, and use appropriate notations such as a/b , a to b , $a:b$.
- M.6.10 The student will explain orally and in writing the concepts of prime and composite numbers.
- M.6.11 The student will compare and order whole numbers, fractions, and decimals, using concrete materials, drawings or pictures, and mathematical symbols.
- M.6.12 The student will identify, represent, order and compare integers on a number line.
- M.6.13 The student will use the commutative, associative, distributive, zero and identity properties.
- M.6.14 The student will read and write whole numbers through billions.
- M.6.15 The student will read and write decimals through millionths.
- M.6.16 The student will round whole numbers and decimals.
- M.6.17 The student will use 0 as a place holder in whole numbers and decimals.
- M.6.18 The student will use exponents to express powers.
- M.6.19 The student will use rules of divisibility for 2, 3, 4, 5, 6, 9 and 10.
- M.6.20 The student will use integers in concrete situations.
- M.6.21 The student will solve problems that involve addition, subtraction, multiplication, and/or division with decimals, and fractions or mixed numbers, with and without regrouping.
- M.6.22 The student will find the quotient, given a dividend expressed as a decimal through thousandths and a divisor to thousandths with exactly one non-zero digit. For divisors with more than one non-zero digit, estimation will be used.
- M.6.23 The student will use estimation strategies to solve multi-step practical problems involving whole numbers, decimals, and fractions.
- M.6.24 The student will multiply or divide by 10, 100, and 1000 mentally.
- M.6.25 The student will compute using mental math, manipulatives, paper and pencil, calculator, and computer in appropriate situations.

- M.6.26 The student will solve multi-step consumer application problems involving fractions and decimals, and present data and conclusions in paragraphs, tables, or graphs.
- M.6.27 The student will convert among fractions, decimals, and percents.
- M.6.28 The student will find the percent of a number, what percent one number is of another, and find a number when the percent is known.
- M.6.29 The student will, given a problem situation, collect, analyze, display, and interpret data in a variety of graphical methods including:
- Line graph;
 - Bar graph;
 - Circle graph (limited to halves, fourths, and eighths);
 - Stem-and-leaf plots;
 - Box-and-whisker plots.
- M.6.30 The student will describe mean, median, mode, and range as measures of central tendency, and determine their meaning from a set of data.
- M.6.31 The student will determine and interpret the probability of an event occurring from a given sample space.
- M.6.31.a The student will compare and contrast dependent and independent events; and determine probabilities for dependent and independent events.
- M.6.32 The student will identify, classify, and describe the characteristics of plane figures including similarities and differences.
- M.6.33 The student will determine whether a problem situation involving quadrilaterals or triangles represents the application of perimeter or area, and apply the appropriate formula(s).
- M.6.34 The student will create and solve problems by finding the circumference and/or area of a circle when given the diameter or radius.
- M.6.35 The student will sketch, construct models, and classify rectangular prisms, cones, cylinders and pyramids.
- M.6.36 The student will investigate the relationship between circumference and diameter to derive an approximation for Pi.
- M.6.37 The student will estimate angle measures using 45 degrees, 90 degrees, and 180 degrees as referents, and use protractors to measure the given angle(s).
- M.6.38 The student will: use a protractor and compass to construct, measure, and bisect lines and angles; use a straight edge and compass to construct perpendicular bisectors of lines and angles.
- M.6.39 The student will understand the concept of symmetry by investigating rotations, reflections, and translations of two-dimensional figures.
- M.6.40 The student will compare and convert units of measures for length, weight/mass, and volume *within* the customary system and *within* the metric system, and estimate conversions between units in each system.

- M.6.41 The student will recognize length as part of an inch ($\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$), inches, feet, yards, miles, millimeters, centimeters, meters and kilometers.
- M.6.42 The student will recognize weight as ounces, pounds and tons, and mass as grams and kilograms.
- M.6.43 The student will recognize liquid volume as cups, pints, quarts, gallons, milliliters, and liters.
- M.6.44 The student will recognize area as square units, and volume as cubic units.
- M.6.45 The student will estimate and then determine length, weight/mass, area, and liquid volume/capacity.
- M.6.46 The students will recognize, describe, analyze, and extend numerical and geometric patterns.
- M.6.47 The student will investigate and use patterns to represent and solve problems.
- M.6.48 The student will generalize patterns, using words and variable expressions.
- M.6.49 The student will investigate and describe concepts of exponents, perfect squares, and square roots, using calculators to develop the exponential patterns. Patterns will include zero and negative exponents, which lead to the idea of scientific notation. Investigation will include the binary number system as an application of exponents and patterns.
- M.6.50 The student will show simple relationships using variables.
- M.6.51 The student will use patterns to analyze relationships to explain how a change in one quantity would change another.
- M.6.52 The student will evaluate whole number numerical expressions using order of operations.
- M.6.53 The student will model and solve equations with one variable, involving whole number coefficients and positive rational solutions.
- M.6.54 The student will identify the coordinates of a point in a coordinate plane; and graph ordered pairs in a coordinate plane.
- M.6.55 The student will graph inequalities on a number line.

GRADE SEVEN

OVERVIEW

The seventh-grade math curriculum is based on the skills introduced and mastered in kindergarten through sixth grades, which will spiral to the seventh-grade level.

Significant additions to the maintenance of these skills include:

- Putting numbers in standard form into scientific notation, and vice versa;
- Analyzing and quantifying percentage change;
- Adding, subtracting, multiplying, and dividing positive and negative integers;
- Setting up proportions to solve a wide variety of problems;
- Representing probability as a fraction, decimal or percent;
- Using the Basic Counting Principle;
- Quantifying predictions based on probability;
- Calculating surface area and volume of solid figures;
- Solving multi-step linear equations and inequalities, using concrete and formal methods (such as tables, graphs, and equations).

Problem solving is integrated throughout the content strands. The development of problem-solving skills is a major goal of the mathematics program at every grade level. Instruction in the process of problem solving, which should include problems involving Catholic Social Teaching, not just textbook word problems, will need to be liberally integrated into each student's mathematics education. Students must be helped to develop a wide range of skills and strategies for solving a variety of problem types. Students should learn to present their mathematical ideas in a variety of forms, including the spoken and written word, pictures, drawings, and graphs. Seventh-grade vocabulary should also be emphasized for each concept, as students are expected to know and use correct mathematical language.

- M.7.1 The student will apply the following strategies to solve problems, including multi-step, non-routine, and real-life problems:
- a. Trial and error;
 - b. Lists or tables;
 - c. Diagrams;
 - d. Patterns;
 - e. Role playing;
 - f. Guess and test;
 - g. Use manipulatives;
 - h. Simplify the problem;
 - i. Write an equation;
 - j. Work backwards.
- M.7.2 The student will verify that a solution is reasonable with respect to the original problem situation.
- M.7.3 The student will understand the use of the calculator and computer for appropriate problem-solving activities.
- M.7.4 The student will problem solve in each math area as well as in other curriculum areas.
- M.7.5 The student will use mathematics to draw conclusions from concrete situations and to justify mathematical arguments.

- M.7.6 The student will express mathematical ideas in oral, written, pictorial, graphic, and symbolic forms.
- M.7.7 The student will use mathematics to solve problems, make predictions, interpret data, and reach conclusions in all subjects.
- M.7.8 The student will compare, order, and determine equivalent relationships between and among fractions, decimals, and percents, including scientific notation.
- M.7.9 The student will use divisibility rules for 2, 3, 4, 5, 6, 8, 9, and 10, mental mathematics, and appropriate tools.
- M.7.10 The student will develop and apply number theory concepts (primes, composites, factors, and multiples).
- M.7.11 The student will recognize and apply number properties (associative, commutative, distributive, zero product, and identity) with algebraic expressions.
- M.7.12 The student will simplify expressions by using order of operations. Exponents will be included.
- M.7.13 The student will compute with whole numbers, simple and complex fractions, decimals and integers.
- M.7.14 The student will identify and write ratios and proportions to represent problem situations, and use proportions to solve practical problems, including scale drawings that contain whole numbers, fractions, decimals, and percents.
- M.7.15 The student will convert among fractions, decimals, and percents.
- M.7.16 The student will find the percent of a number, what percent one number is of another, find a number when the percent is known, and find percentage change as a number either decreases or increases.
- M.7.17 The student will write integer equations to represent problem situations.
- M.7.18 The student will identify and describe absolute value of integers.
- M.7.19 The student will know how to use calculators, computers, and manipulatives to solve computation and estimation problems.
- M.7.20 The student will use, understand, and apply estimation as a problem-solving strategy.
- M.7.21 The student will collect, organize, describe, and represent data in the form of a list, chart, picture, or tree diagram.
- M.7.22 The student will model situations to solve interdisciplinary problems and evaluate conclusions based on data analysis.
- M.7.23 The student will create and solve problems involving mean, median, mode, and range of a set of data.
- M.7.24 The student will understand probability in the context of everyday experiences.
- M.7.25 The student will determine the probability of a given simple event and express that probability as a ratio, decimal, and/or percent, as appropriate for the given situation.

- M.7.26 The student will identify and describe the number of possible arrangements of several objects using a tree diagram or the Basic Counting Principle.
- M.7.27 The student will display and interpret data using frequency distributions, line plots, stem-and-leaf plots, box-and whisker plots, and scattergrams and histograms.
- M.7.28 The student will make inferences and predictions based on theoretical or experimental probabilities.
- M.7.29 The student will identify, describe, compare, contrast, and classify angles, triangles, quadrilaterals, and other polygons.
- M.7.30 The student will develop and apply formulas for area, perimeter, circumference, volume, and surface area of various polygons and three-dimensional figures.
- M.7.31 The student will investigate the relationship between circumference and diameter, and conduct a study of Pi.
- M.7.32 The student will inscribe equilateral triangles, squares, and hexagons in circles, using a compass and straight edge.
- M.7.33 The student will understand the concept of line of symmetry by investigating rotations, reflections, and translations of two and three-dimensional geometric figures.
- M.7.34 The student will recognize and define congruent and similar geometric figures.
- M.7.35 The student will understand and use both customary and metric systems to determine length, weight/mass, area, liquid volume/capacity, and temperature.
- M.7.36 The student will compare and convert units of measures for length, weight/mass, and volume *within* the customary system and *within* the metric system, and estimate conversions between units in each system.
- M.7.37 The student will solve measurement problems, which require selecting and using units of appropriate size and type to measure capacity, length, weight/mass, and temperature.
- M.7.38 The student will solve measurement problems which require selecting and using units of appropriate size and type to measure angles, perimeter, area, surface area, and volume.
- M.7.39 The student will create, extend, describe, and analyze a variety of numerical and geometric patterns.
- M.7.40 The student will use patterns to represent and solve problems.
- M.7.41 The student will generalize patterns using words and variables.
- M.7.42 The student will investigate and describe concepts of exponents, perfect squares, and square roots, using calculators to develop the exponential patterns. Patterns will include zero and negative exponents, which lead to the idea of scientific notation. Investigation will include the binary number system as an application of exponents and patterns.
- M.7.43 The student will use patterns to analyze relationships to explain how a change in one quantity would change another.

- M.7.44 The student will understand the concepts of variables, expressions, equations, and inequalities.
- M.7.45 The student will identify functions, and graph ordered pairs in the four quadrants of a coordinate plane.
- M.7.46 The student will interpret word problems to write and solve multi-step equations and inequalities.
- M.7.47 The student will solve multi-step linear equations using concrete and formal methods (such as tables, graphs, and equations).

GRADE EIGHT

OVERVIEW

The eighth-grade math curriculum is based on the skills introduced and mastered in kindergarten through seventh grades, which will spiral to the eighth-grade level.

Significant additions to the maintenance of these skills include:

- Making scale models;
- Solving problems involving rational numbers and integers;
- Solving problems involving irrational numbers;
- Identifying perfect squares and estimating square roots;
- Using matrices to organize data;
- Converting between customary and metric measurements;
- Writing function rules to describe patterns.
- Using the Pythagorean Theorem by applying it to find the missing length of a right triangle when the lengths of the other two sides are given;
- Using proportions to express and find the relationships between corresponding parts of similar geometric figures;
- Investigating rotations, reflections, translations, and dilations of two and three-dimensional geometric figures.

Problem solving is integrated throughout the content strands. The development of problem-solving skills is a major goal of the mathematics program at every grade level. Instruction in the process of problem solving, which should include problems involving Catholic Social Teaching, not just textbook word problems, will need to be liberally integrated into each student's mathematics education. Students must be helped to develop a wide range of skills and strategies for solving a variety of problem types. Students should learn to present their mathematical ideas in a variety of forms, including the spoken and written word, pictures, drawings, and graphs. Eighth-grade vocabulary should also be emphasized for each concept, as students are expected to know and use correct mathematical language.

- M.8.1 The student will apply the following strategies to solve problems, including multi-step, non-routine, and real-life problems:
- A. Trial and error;
 - B. Lists or tables;
 - C. Diagrams;
 - D. Patterns;
 - E. Role playing;
 - F. Guess and test;
 - G. Use manipulatives;
 - H. Simplify the problem;
 - I. Write an equation;
 - J. Work backwards.
- M.8.2 The student will verify that a solution is reasonable with respect to the original problem situation.
- M.8.3 The student will understand the use of the calculator and computer for appropriate problem-solving activities.
- M.8.4 The student will problem solve in each math area as well as in other curriculum areas.

- M.8.5 The student will use mathematics to draw conclusions from concrete situations and to justify mathematical arguments.
- M.8.6 The student will express mathematical ideas in oral, written, pictorial, graphic, and symbolic forms.
- M.8.7 The student will use mathematics to solve problems, make predictions, interpret data, and reach conclusions in all subjects.
- M.8.8 The student will use proportions to solve scale-model problems with fractions, decimals, and radicals.
- M.8.9 The student will simplify numerical expressions involving exponents, using order of operations.
- M.8.10 The student will describe orally and in writing the relationship between the subsets of the real number system.
- M.8.11 The student will use divisibility rules for 2, 3, 4, 5, 6, 8, 9, and 10.
- M.8.12 The student will recognize and apply number properties (associative, commutative, closure, identity, inverse, zero, distributive) with algebraic expressions.
- M.8.13 The student will understand the conversions among fractions, percents, and decimals, the rounding of irrational numbers, and the conversion of repeating decimals into fractional and percent forms.
- M.8.14 The student will solve practical problems involving integers and rational numbers, including percents. Problems will be of varying complexities, involving real-life data.
- M.8.15 The student will apply order of operations to evaluate algebraic expressions for given replacement values of the variables.
- M.8.16 The student will identify, compare, and compute with rational and irrational numbers.
- M.8.17 The student, given a whole number from 0 to 100, will identify it as a perfect square or find two consecutive whole numbers between which the square root lies.
- M.8.18 The student will collect, organize, describe, read, and interpret tables, charts, and graphs.
- M.8.19 The student will create and solve problems involving mean, median, mode, and range.
- M.8.20 The student will understand theoretical and experimental probability in the context of everyday experiences in order to analyze problem situations such as: games of chance; board games; or grading scales.
- M.8.21 The student will use a matrix to organize, describe, and evaluate conclusions based on data analysis.
- M.8.22 The student will use information displayed in line, bar, circle, and picture graphs and histograms to make comparisons, predictions, and inferences.
- M.8.23 The student will identify, describe, compare, contrast, and classify angles, triangles, quadrilaterals, and other polygons.

- M.8.24 The student will develop and apply geometric formulas for surface area and volume of prisms, cones, cylinders, pyramids, and spheres.
- M.8.25 The student will verify the Pythagorean Theorem by measuring and applying it to find the missing length of a right triangle when the lengths of the other two sides are given.
- M.8.26 The student will write and use proportions to express and find the relationships between corresponding parts of similar geometric figures.
- M.8.27 The student will understand the concept of line of symmetry by investigating rotations, reflections, translations, and dilations of two and three-dimensional geometric figures.
- M.8.28 N/A
- M.8.29 The student will recognize and define congruence and similarity.
- M.8.30 N/A
- M.8.31 The student will describe relationships among the angles formed by two parallel lines cut by a transversal (alternate interior; alternate exterior; corresponding).
- M.8.32 The student will describe the relationships among supplementary, complimentary, and vertical angles, and verify those relationships by measuring the angles.
- M.8.33 The student will understand and use both customary and metric systems to determine length, weight/mass, area, liquid volume/capacity, and temperature.
- M.8.34 The student will solve measurement problems that require converting measurements within the customary system and within the metric system (e.g., feet to miles, milliliters to liters, ounces to pounds).
- M.8.35 The student will solve measurement problems that have both metric and customary units in the same problem, such that the student is required to convert inches to centimeters, yards to meters, pounds to kilograms, liters to gallons, and degrees Fahrenheit to degrees Celsius, without being required to memorize conversion factors.
- M.8.36 The student will solve measurement problems which require selecting and using units of appropriate size and type to measure capacity, length, weight/mass, and temperature.
- M.8.37 The student will solve measurement problems which require selecting and using units of appropriate size and type to measure angles, perimeter, area, surface area, and volume.
- M.8.38 The students will create, extend, describe, and analyze a variety of numerical and geometric patterns.
- M.8.39 The student will use patterns to represent and solve problems.
- M.8.40 The student will generalize patterns using words and variables.
- M.8.41 The student will investigate and describe functions and relations to represent patterns, using tables, graphs, and rules.
- M.8.42 The student will use patterns to analyze relationships to explain how a change in one quantity would change another.

- M.8.43 The student will understand the concepts of variables, expressions, equations, and inequalities.
- M.8.44 The student will model, solve and graph linear equations using concrete and formal methods.
- M.8.45 The student will identify the slopes and y-intercepts of lines by utilizing the slope-intercept form of linear equations, and will also identify slopes of lines from information displayed on linear graphs.
- M.8.46 The student will interpret word problems to write and solve multi-step equations and inequalities in one variable.
- M.8.47 The student will solve and graph linear equations and inequalities.
- M.8.48 The student will identify functions, and graph ordered pairs in the four quadrants of a coordinate plane.
- M.8.49 The student will create and solve problems using proportions and formulas.

ALGEBRA I REVIEW

Prior to entering Algebra I as an eighth grader, the student will have mastered all Diocesan Mathematics Curriculum for students in grades kindergarten through pre-algebra.

Students should have mastered the objectives listed in the Review Section; while the Core Section of the curriculum is new material presented to the students and is the primary focus of Algebra I instruction.

Use of a graphing calculator is **not** part of the Algebra I Diocesan Mathematics Curriculum. Graphing calculators may be used for enrichment only, after all other curriculum have been mastered.

REVIEW SECTION

- A.I.R.1 The student will perform all computational skills without a calculator.
- A.I.R.2 The student will comprehend and apply the concepts of greater than, less than, absolute value.
- A.I.R.3 The student will simplify and compute numerical expressions involving fractions, negatives, decimals, absolute value, percents, etc.
- A.I.R.4 The student will apply the order of operations to the simplification of complicated expressions, with and without grouping symbols.
- A.I.R.5 The student will translate verbal statements into equations.
- A.I.R.6 The student will replace variables with numbers and evaluate expressions, including those with exponents; define base and exponent.
- A.I.R.7 The student will use matrices to organize and manipulate data.
- A.I.R.8 The student will find the probability of an event given a sample space.
- A.I.R.9 The student will use data to find mean, median, and mode and will represent the data graphically.
- A.I. R. 10 The student will identify, distinguish among, and use various subsets of the real numbers:
 - a. Real numbers
 - b. Irrational numbers
 - c. Rational numbers
 - d. Integers
 - e. Whole numbers
 - f. Natural or counting numbers.
- A.I.R.11 The student will graph real numbers on the number line.
- A.I.R.12 The student will graph real number ordered pairs on coordinate planes.
- A.I.R.13 The students will learn and apply correct terminology.
- A.I.R.14 The student will apply real number properties to solve equations in one variable.
- A.I.R.15 The student will solve simple application problems.
- A.I.R.16 The student will solve equations involving percents and proportions.

- A.I.R.17 The student will factor integers (including prime factorization), find greatest common factor and least common multiple of several integers.
- A.I.R.18 The student will use scientific notation and expanded form.
- A.I.R.19 The student will review the concept of order of real numbers and graph inequalities in one variable.
- A.I.R.20 The student will transform inequalities in order to solve them.
- A.I.R.21 The student will learn and apply properties of rational numbers.
- A.I.R.22 The student will express rational numbers as decimals or fractions.
- A.I.R.23 The student will learn and memorize the square of numbers from 1 to 12.
- A.I.R.24 The student will find square roots of numbers that have rational and irrational square roots.
- A.I.R.25 The student will use Pythagorean Theorem and its converse to solve geometric problems.
- A.I.R.26 The student will compare and simplify with rational and irrational numbers.

ALGEBRA I CORE

- A.I.C.1 The student will understand and be able to identify basic algebraic properties and use them efficiently to simplify algebraic expressions.
- A.I.C.2 The student will understand and correctly apply the distributive property.
- A.I.C.3 The student will simplify expressions involving variables raised to powers, including negative and zero (0) powers.
- A.I.C.4 The student will understand, correctly interpret and apply scientific notation.
- A.I.C.5 The student will solve literal equations for any variable.
- A.I.C.6 The student will solve all types of one variable equations and problems, including those with the variable on both sides.
- A.I.C.7 The student will solve application problems using the multi-step plan or charts.
- A.I.C.8 The student will define and use vocabulary:
- Monomial, binomial, trinomial, polynomial
 - Constant, coefficient, similar or like terms
 - Degree of a monomial
 - Degree of a polynomial.
- A.I.C.9 The student will perform operations with polynomials.
- Add and subtract polynomials
 - Multiply polynomials by monomials and polynomials
 - Find powers of monomials using rule of exponents for a power of a power and rule of exponents for power of a product
 - Divide polynomials by monomials and divide polynomials by polynomials using long division.
- A.I.C.10 The student will solve application problems involving polynomials:
- Rate-time-distance problems
 - Area problems.
- A.I.C.11 The student will find quotients and factors, as follows:
- Simplify quotients of monomials and find the greatest common factor of several monomials
 - Find monomial factors of polynomials.
- A.I.C.12 The student will find products and factor as follows:
- Find products of two binomials mentally (using FOIL or similar method)
 - Simplify products of the form $(a+b)(a-b)$ and factor difference of two squares
 - Find the squares of binomials and factor perfect square trinomials.
- A.I.C.13 The student will apply basic factoring techniques to second and simple third degree polynomials. These techniques include finding a common factor for all terms in a polynomial, recognizing the difference of two squares, recognizing perfect square trinomials, factoring general trinomials and factoring by grouping.
- A.I.C.14 The student will solve polynomial equations by factoring and using the zero (0) product property.
- A.I.C.15 The student will simplify rational expressions.

- A.I.C.16 The student will multiply and divide rational expressions.
- A.I.C.17 The student will add and subtract rational expressions with like and unlike denominators.
- A.I.C.18 The student will solve problems involving ratios and proportions.
- A.I.C.19 The student will solve equations with rational expressions and corresponding application problems.
- a. Mixture
 - b. Work
 - c. Percent
- A.I.C.20 The student will graph ordered pairs and linear equations in two variables:
- a. Identify coordinate axes, origin, and quadrants.
- A.I.C.21 The student will find slope of a line as a rate of change and as rise over run.
- A.I.C.22 The student will use slope-intercept form of a linear equation and standard form to find the x and y intercepts.
- A.I.C.23 The student will find an equation of a line given the slope and one point on the line, or given two points on the line using point-slope form.
- A.I.C.24 The student will find equations of lines through a given point with a zero or undefined slope.
- A.I.C.25 The student will find an equation of a line that is parallel or perpendicular to a given line through a given point.
- A.I.C.26 The student will solve linear equations by graphing.
- A.I.C.27 The student will understand what a function is and define a function by using tables, graphs, mapping and ordered pairs.
- A.I.C.28 The student will define a function using functional notation and identifying domain and range of the function.
- A.I.C.29 The student will graph linear and quadratic functions.
- A.I.C.30 The student will solve systems of linear equations in two variables by:
- a. Graphing
 - b. Substitution
 - c. Addition-or-subtraction method with multiplication.
- A.I.C.31 The student will solve application problems using systems of linear equations:
- a. Wind and water current problems
 - b. Age, digit and fraction problems
 - c. Other types of applicable problems.
- A.I.C.32 The student will express the square roots and cube roots of whole numbers.
- A.I.C.33 The student will find the square roots of variable expressions and use them to solve equations and application problems.
- A.I.C.34 The student will work with square-root radical expressions:
- a. Simplify products and quotients of radicals
 - b. Simplify sums and differences of radicals

- c. Multiply binomials containing square-root radicals and rationalize binomial denominators that contain square-root radicals.
- A.I.C.35 The student will solve simple square-root radical equations and corresponding application problems.
- A.I.C.36 The student will solve application problems that involve inequalities.
- A.I.C.37 The student will combine open sentences:
 - a. Find union and intersection of sets, using set notation
 - b. Find solution sets of combined inequalities and graph them on a number line
 - c. Solve equations and inequalities involving absolute value and graph the solution on a number line.
- A.I.C.38 The student will graph linear inequalities in two variables on a coordinate plane.
- A.I.C.39 The student will graph the solution set of a system of two linear inequalities in two variables on a coordinate plane.
- A.I.C.40 The student will solve quadratic equations involving perfect squares.
- A.I.C.41 The student will solve quadratic equations by completing the square.
- A.I.C.42 The student will learn the quadratic formula and use it to solve quadratic equations such as motion of an object under the force of gravity.
- A.I.C.43 The student, given a situation in a real-world context, will analyze a relation to determine whether a direct or inverse variation exists, and represent a direct variation algebraically and graphically and an inverse variation algebraically.
- A.I.C.44 The student, given a set of data, will interpret variation in real-world contexts and calculate and interpret mean absolute deviation, standard deviation, and z-scores.
- A.I.C.45 The student will compare and contrast multiple univariate data sets, using box-and-whisker plots.
- A.I.C.46 The student will collect and analyze data, determine the equation of the curve of best fit in order to make predictions, and solve real-world problems, using mathematical models. Mathematical models will include linear and quadratic functions.

Excellent Resource:

Ask Dr. Math

<http://mathforum.org/library/drmath/drmath.high.html>