2008

Mathematics Curriculum Guide

Catholic Diocese of Wilmington, Delaware

Grade 4 Standards

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Mission

The Catholic school has the responsibility to prepare all students to function effectively in today's society and to bring Christian values to their world. Integral to the complete formation of the child in our Catholic schools is the study of Mathematics. Students of the twenty-first century must be taught to value Mathematics and become competent and confident in reasoning, making connections, and communicating in order to be better problem solvers. They should be able to assimilate new information, solve unfamiliar problems in unconventional ways, and work cooperatively as well as independently. They should also be able to interpret issues, think critically and ethically, and act responsibility.

Vision

As life-long learners, we are challenged to use God's gifts to better understand and improve the world around us. We recognize that we live in a world that is increasingly mathematical and technological and that our students' futures depend on their mathematical competency. Students should be able to assimilate new information, solve unfamiliar problems in unconventional ways, and work cooperatively as well as independently. They should also be able to interpret issues, think critically and ethically, and act responsibly. Teaching strategies and learning experiences must be varied, meaningful, and engaging to students.

Philosophy

Mathematics is learned through an approach that begins with concrete explorations and leads students to an understanding of symbolic representations. All students must have equal access to rigorous, high quality instruction to become mathematically literate. The uniqueness of each student should be nurtured by using differentiated strategies in response to various learning styles. A broad variety of assessments must provide multiple indicators of student achievement.

Communicating mathematically enables students to solve problems by acquiring information through reading, listening, and observing. Students will be able to translate information into mathematical language and symbols, process the information mathematically, and present the results in written, oral, and visual formats to demonstrate their mathematical literacy.

Students achieve mastery of computational skills through the employment of age-appropriate materials while also developing higher-level critical thinking skills. In our progressively changing world, students need to know how to properly utilize innovative tools, media, and technology to solve cross-curricular mathematical problems. Technology, however, is not a replacement for the comprehension of mathematical concepts.

The Mathematics program prepares students to fulfill personal ambitions and career goals in an ever changing world. Classrooms that encourage investigation, collaboration, and

resourcefulness in the problem solving process empower students beyond the classroom. It is through the cornerstones of communication, teamwork, and opportunity that we instill into our students a deeper appreciation and knowledge of mathematics so that they may become productive Catholic citizens of the world.

Goals

All students will:

1. Learn to appreciate mathematics, reason mathematically, and communicate mathematically.
2. Utilize their mathematical skills to become competent problem solvers.
3. Make mathematical connections to real life situations and to other areas of the curriculum.
4. Use technology appropriately and effectively.
5. Apply ethical and critical thinking.

Expectations for Learning

We commit to the following expectations:

1. That all grade levels students:
    - Learn to think critically, logically, ethically, and analytically
    - Learn to express ideas orally and in writing using correct mathematical terminology
    - Learn to apply the techniques of mathematics to real world situations
    - Understand that mathematics is important to function in today's world
    - Utilize technology responsibly
1. That computers, calculators, manipulatives and other tools of learning should be used routinely as an integral part of both instruction and assessment.
2. That mathematics teachers be encouraged to participate in professional development activities.
3. That mathematics coordinators hold regularly scheduled faculty meetings to facilitate communication and to analyze the strengths and weaknesses within the program.
4. That the teacher utilize the mathematics curriculum guidelines for grade level instruction.
5. That teachers provide differentiated instruction and assessment.

GRADE FOUR

***As life-long learners**, we are challenged to use God's gifts to better understand and improve the world around us. We recognize that we live in a world that is increasingly mathematical and technological and that our students' futures depend on their mathematical competency. Students should be able to assimilate new information, solve unfamiliar problems in unconventional ways, and work cooperatively as well as independently. They should also be able to interpret issues, think critically and ethically, and act responsibly. Teaching strategies and learning experiences must be varied, meaningful, and engaging to students.*

The Diocese of Wilmington has established the following mathematics Standards to clarify for teachers, students, and parents the knowledge, understanding, and skills students should attain in GRADE FOUR:

Standard 1 — Number Sense

Developing number sense is the foundation of mathematics. Students extend their understanding of the place value system to count, read, and write whole numbers up to 1,000,000 and decimals to two places. They order and compare whole numbers using the correct symbols for greater than and less than. They extend the concept of fractions to mixed numbers, learning how fractions are related to whole numbers. They also extend their skills with decimals and how they relate to fractions.

Standard 2 — Computation

Mastering computational skills is vital. As students learn about numbers, they also learn how to add, subtract, multiply, and divide them. They understand the special roles of 0 and 1 in multiplication and division. They also add and subtract fractions and decimals, learning how these different representations of numbers can be manipulated.

Standard 3 — Algebra and Functions

Understanding patterns, rules, and symbols is the foundation of Algebra. Students at this level develop an understanding of the fundamental concept of a variable — having a letter represent all numbers of a certain kind. They use this to write formulas and equations, including equations that give the rule for a function. They continue number patterns involving multiplication and division. They recognize and apply the relationships among the four operations of addition, subtraction, multiplication, and division. They further develop the connection between numbers and number lines, including estimating positions on
a number line.

Standard 4 — Geometry

Exploring shapes and developing spatial sense is the basis of Geometry. They identify, describe, and draw such concepts as acute angles and parallel lines. They describe shapes and objects, including special quadrilaterals such as rhombuses and trapezoids. They identify congruent quadrilaterals and explain their reasoning using specific geometric terms. They draw lines of

symmetry for various polygons, and they construct cubes and prisms, developing their ability to work in three-dimensional figures.

Standard 5 — Measurement

Using measurement is essential to everyday life. Students measure length to the nearest eighth-inch and millimeter and subtract units of length. They develop and use the formulas for calculating perimeters and areas of rectangles. They compare the concepts of volume and capacity. They add time intervals and calculate the amount of change from a purchase.

Standard 6 — Data Analysis and Probability

Data are all around us — in newspapers and magazines, in television news and commercials, in quality control for manufacturing — and students need to learn how to understand data. At this level, they represent data on a number line and in frequency tables, interpret data graphs to answer questions, and summarize the results of probability experiments in an organized way.

Standard 7 — Problem Solving

Solving problems is the practical application of mathematics. In all mathematics, students use problem-solving skills: they choose how to approach a problem, they explain their reasoning, and they check their results. As they develop their skills with numbers, geometry, or measurement, for example, students move from simple ideas to more complex ones by taking logical steps that build a better understanding of mathematics.

Students should also develop the following learning skills by Grade 12 that are integrated throughout the National Council of Teachers of Mathematics (NCTM) Standards:

Communication

As students are asked to communicate orally or in writing about the mathematics they are studying, they gain insights into their own thinking. In order to communicate their thinking to others, they naturally reflect on their learning and organize and consolidate their thinking about mathematics. Students should be encouraged and expected to increase their ability to express themselves clearly and coherently over time. In particular, the ability to express thoughts and describe solutions in writing should be a major focus of the mathematics curriculum.

Reasoning and Proof

Systematic reasoning is a defining feature of mathematics. Exploring, justifying, and using mathematical conjectures are common to all content areas and, with different levels of rigor, all grade levels. By the end of secondary school, students should be able to understand and produce some mathematical proofs – logically rigorous deductions of conclusions from mathematical hypotheses – and should appreciate the value of such arguments.

Connections
Mathematics is an integrated field of study, even though it is often studied in separate areas or topics. Viewing mathematics as a whole helps students learn that mathematics is not a set of isolated skills and arbitrary rules. Focusing on mathematics in context and establishing mathematical connections makes it easier to apply mathematical knowledge and makes it less likely that students will forget or misapply important mathematical skills and rules.

Representation
Representations are necessary to students' understanding of mathematical concepts and relationships. They allow students to communicate mathematical approaches, arguments, and understandings to themselves and others. Appropriate representations allow students to recognize connections among related concepts, and lead to efficient methods of solving problems.

It is important to encourage students to represent their mathematical ideas in ways that make sense to them, even if those representations are not conventional. At the same time, students should learn conventional forms of representation in ways that facilitate their learning of mathematics and their communication with others about mathematical ideas.

Standard 1

Number Sense

Students understand the place value of whole numbers and decimals to two decimal places and how whole numbers and decimals relate to simple fractions.

4.1.1 Read and write whole numbers through the millions in standard form, expanded form, and word form.

Example: Read aloud the number 124, 394,734.

Expanded form: 1 hundred millions, 2 ten millions, 4 millions, 3 hundred thousand, 9 ten thousands, 4 thousands, 7 hundred, 3 tens, 4 ones

Word form: three hundred ninety four thousand, seven hundred thirty four.

4.1.2 Identify and write whole numbers through the millions given a place-value model.

Example: Write the number that has 2 hundred million, 5 ten million, 4 million, 2 hundred thousands, 7 ten thousands, 4 thousands, 8 hundreds, 6 tens, and 2 ones.

4.1.3 Identify even and odd numbers and perform selected mathematical operations.

Example: Is 287 even or odd? Explain.

Example: 4 + 7 = 11

4.1.4 Identify prime and composite numbers.

Example: Is 8 prime or composite? Explain.

4.1.5 Identify the rule of the pattern.

Example: Find the missing numbers in the pattern. 3, 6, 9, …

4.1.6 Round whole numbers through the millions to a designated place value.

Example: Is 7,683 closer to 7,600 or 7,700? Explain your answer.

Example: Is 187,567 closer to 180,000 or 180,000? Explain your answer.

4.1.7 Order and compare whole numbers and like fractions using symbols for "less than" (<), "equal to" (=), and "greater than" (>).

Example: Put the correct comparison symbol in 328,875 __ 328,934.

Example: ¼ ___ ¾

4.1.8 Rename and rewrite whole numbers as fractions.

Example: $3 = \frac{6}{2} = \frac{9}{3} = \frac{?}{4} = \frac{?}{5}$.

4.1.9 Name and write mixed numbers, using objects or pictures.

Example: You have 5 whole straws and half a straw. Write the number that represents these objects.

4.1.10 Name and write mixed numbers as improper fractions, using objects or pictures.

Example: Use a picture of 3 rectangles, each divided into 5 equal pieces, to write $2\frac{3}{5}$ as an improper fraction.

4.1.11 Compare and order fractions with unlike denominators.

Example: Use the correct comparison symbol. ½ __⅛

4.1.12 Write tenths and hundredths in decimal and fraction notations. Know the fraction and decimal equivalents for halves and fourths (e.g., $\frac{1}{2} = 0.5 = 0.50$, $\frac{7}{4} = 1\frac{3}{4} = 1.75$).

Example: Write $\frac{26}{100}$ and 3/100 as decimals.

4.1.13 Round two-place decimals to tenths or to the nearest whole number.

Example: You ran the 50-yard dash in 6.73 seconds. Round your time to the nearest tenth.

4.1.14 Compare and order decimals through the hundredths.

Example: Use the correct comparison symbol. 0.98 __ 0.91

Standard 2

Computation

Students solve problems involving addition, subtraction, multiplication, and division of whole numbers and understand the relationships among these operations. They extend their use and understanding of whole numbers to the addition and subtraction of simple fractions and decimals.

4.2.1 Use mental arithmetic to add or subtract numbers rounded through the millions.

Example: Add 3,000,000 to 8,000,000 without using pencil and paper.

4.2.2 Know and use strategies for estimating results of any whole-number computations.

Example: Your friend says that 45,329 + 6,984 = 5,213. Without solving, explain why you think the answer is wrong.

4.2.3 Understand and use standard algorithms* for addition and subtraction.

Example: 45,329 + 6,984 = ?, 36,296 – 2,075 = ?.

4.2.4 Represent as multiplication any situation involving repeated addition.

Example: Each of the 20 students in your physical education class has 3 tennis balls. Find the total number of tennis balls in the class.

4.2.5 Represent as division any situation involving the sharing of objects or the number of groups of shared objects.

Example: Divide 12 cookies equally among 4 students. Divide 12 cookies equally to find out how many people can get 4 cookies. Compare your answers and methods.

4.2.6 Demonstrate mastery of the multiplication tables for numbers from 0 to 12 and of the corresponding division facts.

Example: Know the answers to 9×4 and $35 \div 7$.

4.2.7 Explore the identity, zero, commutative, associative, and distributive properties of addition and multiplication.

Example: Know that $73 \times 0 = 0$ and that $42 \div 1 = 42$.

4.2.8 Use a standard algorithm to multiply four digit numbers by two digit multipliers, using relevant properties of the number system.

Example: $3{,}710 \times 23 = ?$.

4.2.9 Use long division to divide four digit numbers by one digit divisors, with and without remainders, using remainder and fractional forms.

Example: $2{,}762 \div 5 = ?$.

4.2.10 Add and subtract simple fractions with different denominators, using objects or pictures.

Example: Use a picture of a circle divided into 6 equal pieces to find $\frac{5}{6} - \frac{1}{3}$.

4.2.11 Add and subtract decimals (to hundredths), using objects or pictures.

Example: Use coins to find $0.43 – 9¢.

4.2.12 Use a standard algorithm to add and subtract decimals (to hundredths).

Example: 0.74 + 0.80 = ?.

Standard 3

Algebra and Functions

Students use and interpret variables, mathematical symbols, and properties to write and simplify numerical expressions and sentences. They understand relationships among the operations of addition, subtraction, multiplication, and division.

4.3.1 Use letters, boxes, or other symbols to represent any number in simple expressions, equations, or inequalities (i.e., demonstrate an understanding of and the use of the concept of a variable).

Example: You read the expression "some number added to 5 equals 15" and you write "*n* + 5 = 15." What does *n* represent?

4.3.2 Use and interpret formulas to answer questions about quantities and their relationships.

Example: Write the formula for the area of a rectangle in words. Now let *l* stand for the length, *w* for the width, and *A* for the area. Write the formula using these symbols.

4.3.3 Understand that multiplication and division are performed before addition and subtraction in expressions without parentheses.

Example: You go to a store with 90¢ and buy 3 pencils that cost 20¢ each. Write an expression for the amount of money you have left and find its value.

4.3.4 Continue number patterns using function tables.

Example: Given the rule $a = b + 4$, find a when b is 3.

4.3.5 Recognize and apply the relationships between addition and multiplication, between subtraction and division, and the inverse relationship between addition/subtraction, multiplication/division to solve problems.

Example: Find another way of writing 13 + 13 + 13 + 13 + 13.

4.3.6 Relate problem situations to number sentences involving multiplication and division.

Example: You have 150 jelly beans to share among the 30 members of your class. Write a number sentence for this problem and use it to find the number of jelly beans each person will get.

4.3.7 Plot and label numbers on a number line through the millions. Estimate positions on the number line.

Example: Draw a number line and label it with 0, 1000, 2000, 3000, …, 9000, 10000. Estimate the position of 7700 on this number line.

4.3.8 Represent and describe mathematical relationships of ordered pairs by listing in a table, plotting on a graph, and looking for a pattern.

Example: Plot the following ordered pairs on a graph and find a pattern.

x	*y*
2	1
3	2
4	3

Standard 4

Geometry

Students show an understanding of plane and solid geometric objects and use this knowledge to show relationships and solve problems.

4.4.1 Identify, define, and draw line segments, lines, rays, right angles, acute angles, obtuse angles, and straight angles using appropriate mathematical tools and technology.

Example: Draw two rays that meet in an obtuse angle.

4.4.2 Identify, define, and draw parallel, perpendicular, and oblique lines using appropriate mathematical tools and technology.

Example: Use the markings on the gymnasium floor to identify two lines that are parallel. Place a jump rope across the parallel lines and identify any obtuse angles created by the jump rope and the lines.

4.4.3 Identify, define, and draw parallelograms, rhombuses, and trapezoids, using appropriate mathematical tools and technology.

Example: Use a geoboard to make a parallelogram. How do you know it is a parallelogram?

4.4.4 Introduce similar and congruent polygons and give reasons for congruence using sides, angles, parallels, and perpendiculars.

Example: In a collection of parallelograms, rhombuses, and trapezoids, pick out those that are the same shape and size and explain your decisions.

4.4.5 Identify and draw lines of symmetry in polygons.

Example: Draw a rectangle and then draw all its lines of symmetry.

4.4.6 Construct cubes and prisms and identify the number of faces, edges, and vertices.

Example: Make a 6-sided prism from construction paper.

4.4.7 Identify cones, cylinders, prisms, pyramids.

Example: Identify the geometric shape of a soda can.

4.4.8 Identify flips (reflections), slides (translations), and turns (rotations).

Example: Rotate the hands on a clock.

Standard 5

Measurement

Students understand perimeter and area, as well as measuring volume, capacity, time, and money.

4.5.1 Measure length in US Customary (from yards to sixteenth-inch) and Metric (from meters to millimeters).

Example: Measure the width of a sheet of paper to the nearest millimeter.

4.5.2 Subtract units of length that may require renaming of feet to inches or meters to centimeters.

Example: The shelf was 2 feet long. Jane shortened it by 8 inches. How long is the shelf now?

4.5.3 Know and use formulas for finding the perimeters of rectangles and squares.

Example: The length of a rectangle is 4 cm and its perimeter is 20 cm. What is the width of the rectangle?

4.5.4 Know and use formulas for finding the areas of rectangles and squares.

Example: Draw a rectangle 5 inches by 3 inches. Divide it into one-inch squares and count the squares to find its area. Can you see another way to find the area? Do this with other rectangles.

4.5.5 Estimate and calculate the area of rectangular shapes using appropriate units, such as square centimeter (cm^2), square meter (m^2), square inch (in^2), or square yard (yd^2).

Example: Measure the length and width of a basketball court and find its area in suitable units.

4.5.6 Understand that rectangles with the same area can have different perimeters and that rectangles with the same perimeter can have different areas.

Example: Make a rectangle of area 12 units on a geo-board and find its perimeter. Can you make other rectangles with the same area? What are their perimeters?

4.5.7 Find areas of complex shapes by dividing them into basic shapes such as rectangles.

Example: Find the area of your school building.

4.5.8 Use volume and capacity as different ways of measuring the space inside a shape.

Example: Use cubes to find the volume of a fish tank and a pint jug to find its capacity.

4.5.9 Add and subtract time intervals involving hours and minutes.

Example: During the school week, you have 5 recess periods of 15 minutes. Find how long that is in hours and minutes.

4.5.10 Determine the amount of change from a purchase.

Example: You buy a chocolate bar priced at $1.75. How much change do you get if you pay for it with a five-dollar bill?

4.6.11 Read a thermometer (Fahrenheit and Celsius) and other types of scales (speedometer and gauges).

Example: Given a thermometer, estimate the temperature on a hot sunny day.

Standard 6

Data Analysis and Probability

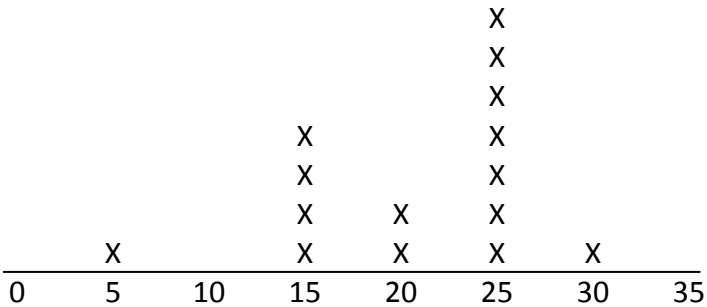
Students organize, represent, and interpret numerical and categorical data and clearly communicate their findings. They show outcomes for simple probability situations.

4.6.1 Represent data on a number line, in graphs (line, bar and pictograph), and in tables (including frequency tables).

Example: The students in your class are growing plants in various parts of the classroom. Plan a survey to measure the height of each plant in centimeters on a certain day. Record your survey results on a line plot.

4.6.2 Interpret data graphs to answer questions about a situation.

Example: The line plot below shows the heights of fast-growing plants reported by third-grade students. Describe any patterns that you can see in the data using the words “most,” “few,” and “none.”



Plant Heights in Centimeters

4.6.3 Summarize and display the results of probability experiments in a clear and organized way.

Example: Roll a number cube 36 times and keep a tally of the number of times that 1, 2, 3, 4, 5, and 6 appear. Draw a bar graph to show your results.

4.6.4 Use vocabulary to describe outcomes (possible/impossible, certain/uncertain, less likely, equally likely, more likely).

Example: What is the probability of rolling a 7 with a dime (possible/impossible)

4.6.5 Find the mean, median, mode, and range for a given set of numbers.

Example: Find the mean, median, mode, and range for the following test grades: 98, 76, 83, 89, 91

Standard 7

Problem Solving

Students make decisions about how to approach problems and communicate their ideas.

4.7.1 Analyze problems by identifying relationships, telling relevant from irrelevant information, sequencing and prioritizing information, and observing patterns.

Example: Solve the problem: "Find a relationship between the number of faces, edges, and vertices of a solid shape with flat surfaces." Try two or three shapes and look for patterns.

4.7.2 Decide when and how to break a problem into simpler parts.

Example: In the first example, find what happens to cubes and rectangular solids.

Students use strategies, skills, and concepts in finding and communicating solutions to problems.

4.7.3 Apply strategies and results from simpler problems to solve more complex problems.

Example: In the first example, use your method for cubes and rectangular solids to find what happens to other prisms and to pyramids.

4.7.4 Use a variety of methods, such as words, numbers, symbols, charts, graphs, tables, diagrams, tools, and models to solve problems, justify arguments, and make conjectures.

Example: In the first example, make a table to help you explain your results to another student.

4.7.5 Express solutions clearly and logically by using the appropriate mathematical terminology and notation. Support solutions with evidence in both verbal and symbolic work.

Example: In the first example, explain what happens with all the shapes that you tried.

4.7.6 Recognize the relative advantages of exact and approximate solutions to problems and give answers to a specified degree of accuracy.

Example: You are telling a friend the time of a TV program. How accurate should you be: to the nearest day, hour, minute, or second?

4.7.7 Know and use appropriate methods for estimating results.

Example: You buy 2 CDs for $15.95 each. The cashier tells you that will be $49.90. Does that surprise you?

4.7.8 Make precise calculations and check the validity of the results in the context of the problem.

Example: The buses you use for a school trip hold 55 people each. How any buses will you need to seat 180 people?

Students determine when a solution is complete and reasonable and move beyond a particular problem by generalizing to other situations.

4.7.9 Decide whether a solution is reasonable in the context of the original situation.

Example: In the last example, would an answer of 3.27 surprise you?

4.7.10 Note the method of finding the solution and show a conceptual understanding of the method by solving similar problems.

Example: Change the first example so that you look at shapes with curved surfaces.