Mathematics Curriculum Guide

Catholic Diocese of Wilmington, Delaware

Pre-Kindergarten Standards
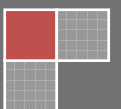
Mission

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.

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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 PRE-KINDERGARTEN:

Standard 1 — Number Sense
Developing number sense is the foundation of mathematics. Students develop this understanding by first comparing the number of objects (such as blocks) in a given set. From comparing sets of objects, they develop the concept of counting: matching each object in a set with a counting number. Then they use counting to recognize, name, and order up to ten objects

Standard 2 — Computation
Mastering computational skills is vital. As students learn about numbers, they also learn how to join sets together (for addition) and to remove objects from sets (for subtraction).

Standard 3 — Algebra and Functions (Patterns)
Understanding patterns, rules, and symbols is the foundation of Algebra. Students at this level sort and classify objects according to various rules. Students make and extend simple patterns of sound and physical movement.

Standard 4 — Geometry
Exploring shapes and developing spatial sense is the basis of Geometry. Students identify and describe simple shapes and solids, comparing and sorting them by such attributes as size and roundness. They learn the meaning of positional and directional words that relate to space.

Standard 5 — Measurement
Using measurement is essential to everyday life. Students begin their study of measurement by comparing objects' length, weight, temperature, etc. They use words like first, next, and last.

Standard 6 — Data Analysis and Probability
Analyzing data is a fundamental life skill. Students develop methods of collecting, organizing, describing, displaying, and interpreting data to answer yes/no questions. The students will create graphs and tables and begin to interpret their results.

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 at this level 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

The ability to read, write, listen, ask questions, think, and communicate about math will develop and deepen students' understanding of mathematical concepts. Students should read text, data, tables, and graphs with comprehension and understanding. Their writing should be detailed and coherent, and they should use correct mathematical vocabulary. Students should write to explain answers, justify mathematical reasoning, and describe problem-solving strategies.

Reasoning and Proof

Mathematics is developed by using known ideas and concepts to develop others. Repeated addition becomes multiplication. Multiplication of numbers less than ten can be extended to numbers less than one hundred and then to the entire number system. Knowing how to find the area of a right triangle extends to all right triangles. Extending patterns, finding even numbers, developing formulas, and proving the Pythagorean Theorem are all examples of mathematical reasoning. Students should learn to observe, generalize, make assumptions from known information, and test their assumptions.

Representation

The language of mathematics is expressed in words, symbols, formulas, equations, graphs, and data displays. The concept of one-fourth may be described as a quarter, $1/4$, one divided by four, 0.25, $1/8 \_ 1/8$, 25 percent, or an appropriately shaded portion of a pie graph. Higher-level mathematics involves the use of more powerful representations: exponents, logarithms, unknowns, statistical representation, algebraic and geometric expressions. Mathematical operations are expressed as representations: _, _, divide, square. Representations are dynamic tools for solving problems and communicating and expressing mathematical ideas and concepts.

Connections

Connecting mathematical concepts includes linking new ideas to related ideas learned previously, helping students to see mathematics as a unified body of knowledge whose concepts build upon each other. Major emphasis should be given to ideas and concepts across mathematical content areas that help students see that mathematics is a web of closely connected ideas (algebra, geometry, the entire number system). Mathematics is also the common language of many other disciplines (science, technology, finance, social science, geography) and students should learn mathematical concepts used in those disciplines. Finally, students should connect their mathematical learning to appropriate real-world contexts.

Standard 1

Number Sense

Students understand the relationship between numbers and quantities up to 10, and that a set of objects has the same number in all situations regardless of the position or arrangement of the objects.

PK.1.1   Count by ones to ten or higher (by rote).
Example: Count orally beginning at one. Utilize songs and/or finger plays.

PK.1.2   Compare numbers of objects using language.
Example: Compare the blocks in two boxes. Tell which box contains more blocks and explain the way in which you decided on your answer.

PK.1.3   Use one-to-one correspondence to arrange and compare sets. Use classroom experiences to indicate same, more, less
Example: Match a set of 5 bears with 5 cars.

PK.1.4   Count, recognize, represent, name, and order sets of up to ten objects.
Example: Count a set of 5 objects. Recognize that the number 5 is the number for that set.

PK.1.5   Identify first, middle, and last in a series. Use ordinal numbers from first to tenth.
Example: By putting students in a line, identify the position in line.

PK.1.6 Explore the concepts of whole, part, and parts that make a whole.
Example: Divide an apple. Discuss whole and parts.

PK.1.7 Recognize and describe the concept of zero.
Example: Start with a set of objects. Remove all the objects to explain zero as the absence of objects.

PK.1.8 Use numbers to predict, estimate, and make realistic guesses.
Example: Use animal crackers in a small container. Look at the container to guess the number of crackers.

Standard 2

Computation

Students understand the concept of combining and separating

PK.2.1 Develop the meaning of joining, separating sets, naming how many.
Example: Use a story about farm animals. Two pigs are in the mud. One joins them. How many pigs are there now (use animal counters).

Standard 3

Algebra and Functions (Patterns)

Students identify and create patterns.

PK.3.1 Reproduce, create, and extend simple, repeating patterns of sound and physical movement.
> Example: Students will clap hand and stomp feet in a pattern.

PK.3.2 Identify patterns in real world situations.
> Example: Using a daily symbol, identify the pattern (a a b, a b b, etc) on a calendar.

Standard 4

Geometry

Students identify common objects around them and describe their geometric features and position.

PK.4.1 Recognize, name, describe, and combine simple geometric shapes and solids (circle, square, triangle, rectangle, cube, sphere, cone, cylinder).
> Example: A circle is round. A triangle has 3 corners. Etc.

PK.4.2 Understand and describe position, direction, distance using words such as near, far, over, under, above, in, next to, below, beside, behind.
> Example: Using manipulatives, show the bear inside the basket, under the basket, etc.

PK.4.3 Demonstrate an awareness of symmetry.
> Example: Fold paper in half. Cut a shape. Open to reveal the symmetry.

PK.4.4 Sort objects by attribute such as shape, size, and color.
> Example: Using a variety of objects on the table, sort by color, sort by shape, etc.

Measurement

Students understand that objects have length, capacity, weight, and temperature, and that they can compare objects using these qualities.

PK.5.1   Use language associated with time in everyday situations (first, next, last).
    Example: Use daily routine: first we wash our hands; next we put on our coats, last we go to the playground.

PK.5.2   Begin to recognize time intervals (morning, afternoon, evening).
    Example: Use self care examples to explain daily activities. Eat breakfast in the morning, go to the playground in the afternoon, etc.

PK.5.3   Examine, manipulate, and identify familiar U.S. coins.
    Example: Upon arrival, choose the coin of the day, and "pay the jar."

PK.5.4   Use non-standard measures to explore length and area.
    Example: Use unifix blocks to measure paperclips.

PK.5.5   Introduce standard tools for measuring time, temperature, and length.
    Example: Use a measuring cup to pour water into a pitcher.

Standard 6

Data Analysis and Probability

Students collect, organize, and display, analyze, and interpret data.

PK.6.1   Compare and contrast objects.
    Example: Using an apple and a banana, describe color, length, shape, etc.

PK.6.2   Sort objects and explain how the sorting was done.
    Example: Using sets of bear counters, explain how to group by color, size, etc.

PK.6.3   Use charts and graphs.
    Example: Chart the daily weather.

PK.6.4   Explore data by answering yes/no questions.
    Example: Students hide an object from the teacher. Teacher asks questions about the object and students answer yes/no.

Problem Solving

Students make decisions about how to set up a problem.

PK.7.1   Explore and solve a simple, orally presented problem.
  Example: Talk about the number of students in the class with blue eyes.

PK.7.2   Identify the question in a problem:
  Example: In the first example, how we can we find out how many students have blue eyes?

PK.7.3   Decide if enough information is present to solve the problem.
  Example: If a student is absent from the class, can we determine the color of his/her eyes?