Bethlehem Township School District
Mathematics Curriculum

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Bethlehem Township School District
Mathematics Curriculum
Grades K-8

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Mission Statement

The mission of the Bethlehem Township School District, in partnership with the community, is to provide a safe, nurturing child-centered environment that challenges each child to maximize his/her potential. Our students will acquire the skills and knowledge to enable them to become independent, respectful, responsible citizens who strive for excellence and embrace learning as fundamental to successfully adapt to our ever changing global community.

WE BELIEVE THAT CHILDREN LEARN BEST WHEN:

- They are provided with an integrated child-centered curriculum that is relevant, authentic, dynamic, and emphasizes active participation of the learning community.
- Expectations are clearly communicated and reflect:
  - that all children can learn
  - a commitment to responsibility
  - developmentally appropriate and authentic experiences
  - a commitment to high quality
  - active student participation
  - both process and product
- The school environment:
  - is emotionally and physically safe and nurturing
  - reflects collaboration and cooperation within the learning community
  - fosters positive self-esteem
  - provides opportunities for success
  - encourages a commitment to lifelong learning
  - promotes the district code of ethics meets the affective needs of children at different stages of maturation

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Philosophy

It is the belief of the Bethlehem Township School District that all children can reason and communicate proficiently in mathematics and that they will develop the mathematical skills, knowledge, and understandings that are needed be successful in life. Our mathematics curriculum is aligned with the New Jersey Core Mathematics Content Standards and the National Council of Teachers of Mathematics Standards.

The program develops each child's understanding of the big ideas and concepts of mathematics and his/her reasoning abilities in order to define and solve problems with proficiency. The K-8 program is committed to ensuring an enthusiasm for mathematical learning, an understanding of math concepts, and the application of basic math skills through developmentally appropriate and meaningful experiences.

To achieve mathematical literacy we believe:

- all students can learn and understand math in order to define and solve problems
- teaching strategies will address a variety of learning abilities and styles
- students construct their own meaning based on prior knowledge and should be encouraged to take risks to develop their own problem solving strategies
- a collaborative, cooperative classroom environment enhances learning
- learning is relevant to students' lives and is tied to real world problems across the curricula
- all students need to communicate their mathematical thinking by engaging in, exploring, explaining and discussing, and writing about their understandings of math concepts
- learning math is a shared responsibility between teachers, students, and parents
- math instruction includes content as well as process skills.

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Curriculum Description

The Bethlehem Township School District mathematics curriculum is aligned with the New Jersey Core Mathematics Content Standards and the National Council of Teachers of Mathematics Standards. Our math curriculum integrates the process standards of problem solving, communication, connections, reasoning, representation, and technology with number sense, geometry, measurement, patterns and algebra, data analysis, probability, and discrete mathematics.

Students investigate the big ideas of mathematics through active engagement and exploration. By using manipulative materials and mathematical tools in an inquiry based setting students can develop a deeper understanding of the meaning behind the procedures. Our curriculum allows students to develop both a conceptual understanding of mathematics and a procedural proficiency with numbers. Teachers incorporate inquiry based instructional strategies by encouraging the engagement and exploration of math concepts. Students explain and analyze each others thinking through ongoing communication and collaboration.

Assessment consists of both formative and summative assessments. Observations of students as they problem solve, their responses to questions, and their daily work provide teachers with ongoing qualitative feedback. Projects, daily work, teacher made tests, unit tests, and state tests are used for quantitative assessment. All provide data with which to inform and differentiate instruction in every classroom.

Textbooks, manipulative materials, activity books and supplemental materials are used in all classrooms. Teacher instruction is differentiated and modified as necessary in order to meet the needs of all students. Students in Kindergarten through grade 5 are heterogeneously grouped. In grades 6-8 there is an accelerated math level for those students meeting the district criteria in addition to the heterogeneous groups. Additional math instruction is provided as small group instruction, in class support and/or special programs in grades K-8.

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New Jersey Core Math Content Standards

****_New Jersey Core Curriculum Content Standards for Mathematics_, New Jersey Department of Education, Office of Academic Standards, January 2008**
http://www.state.nj.us/education/educators/standards.htm

4.1 Number and Numerical Operations

Students will develop number sense and perform standard numerical operations and estimations of all types of numbers in a variety of ways.

A. Number Sense

Number sense is an intuitive feel for numbers and a common sense approach to using them. It is a comfort with what numbers represent that comes from investigating their characteristics and using them in diverse situations. It involves an understanding of how different types of numbers, such as fractions and decimals, are related to each other, and how each can be best used to describe a particular situation. It subsumes the more traditional category of school mathematics curriculum called numeration and thus includes the important concepts of place value, number base, magnitude, and approximation and estimation.

B. Numerical Operations

Numerical operations are an essential part of the mathematics curriculum, especially in the elementary grades. Students must be able to select and apply various computational methods, including mental math, pencil and paper techniques, and the use of calculator. Students must understand how to add, subtract, multiply and divide whole numbers, fractions, decimals, and other kinds of numbers. With the availability of calculators that perform these operations quickly and accurately, the instructional emphasis is on understanding the meanings and uses of these operations and on estimation and mental skills, rather than solely on the development of paper and pencil proficiency.

C. Estimation

Estimation is the process that is used constantly by mathematically capable adults, and one that can be easily mastered by children. It involves and educated guess about a quantity or an intelligent prediction of the outcome of a computation. The growing use of calculators makes it more important than ever that students know when a computed answer is reasonable; the best way to make that determination is through the use of strong estimation skills. Equally important is an awareness of the many situations in which an approximate answer is as good as or even preferable to, an exact one. Students can learn to make these judgments and use mathematics more powerfully as a result.

4.2 Geometry and Measurement

Students will develop spatial sense and the ability to use geometric properties, relationships and measurement to model, describe, and analyze phenomena.

A. Geometric Properties

This includes identifying, describing, and classifying standard geometric objects, describing and comparing properties of geometric objects, make conjectures concerning them, and using reasoning and proof to verify or refute conjectures and theorems. Also included here are the concepts of symmetry, congruence, and similarity.

B. Transforming Shapes

Analyzing how various transformations affect geometric objects allows students to enhance their spatial sense. This includes combining shapes to form new ones and decomposing complex shapes into simpler ones. It includes the standard geometric transformations of translation (slide), reflection (turn), and dilation (scaling). It also includes tessellations and fractals to create geometric patterns.

C. Coordinate Geometry

Coordinate geometry provides an important connection between geometry and algebra. It facilitates the visualization of algebraic relationships, as well as an analytical understanding of geometry.

D. Units of Measurement

Measurement helps describe our world using numbers. An understanding of how we attach numbers to real world phenomena, familiarity with common measurement units (i.e. inches, liters, and miles per hour) and a practical knowledge of measurement tools and techniques are critical for students' understanding of the world around them.

E. Measuring Geometric Objects

This area focuses on applying the knowledge and understanding of units of measurement in order to actually perform measurement. While students will eventually apply formulas, it is important that they develop and apply strategies that derive from their understanding of the attributes. In addition to measuring objects directly, students apply indirect measurement skills, using, for example, similar triangles and trigonometry.

4.3 Patterns and Algebra

Students will represent and analyze relationships among variable quantities and sole problems involving patterns, functions, and algebraic concepts and processes.

A. Patterns

Algebra provides the language through which we communicate the patterns in mathematics. From the earliest age, students should be encouraged to investigate the patterns that they find in numbers, shapes, and expressions, and by doing so, to make mathematical discoveries. They should have opportunities to analyze, extend, and create a variety of patterns and to use pattern-based thinking to understand and represent mathematical and other real world phenomena.

B. Functions and Relationships

The function concept is one of the most fundamental unifying ideas of modern mathematics. Students begin their study of functions in the primary grades, as they observe and study patterns. As students grow and their ability to abstract matures, students form rules, display information in a table or chart, and write equations which express the relationships they have observed. In high school they use the more formal language of algebra to describe these relationships.

C. Modeling

Algebra is used to model real situations and answer questions about them. This use of algebra requires the ability to represent data in tables, pictures, graphs, equations or inequalities, and rules. Modeling ranges from writing simple number sentences to help solve story problems in the primary grades to using functions to describe t he relationships between two variables, such as the height of a pitched ball over time. Modeling also includes some of the conceptual building blocks of calculus, such as how quantities change over time and what happens in the long run limits).

- Recognize and describe changes over time (temperature, height)
- Construct and solve simple addition and subtraction open sentences
    - Result unknown (6-2=___ or n= 3+5)
    - Part unknown (3+___ = 8)

D. Procedures

Techniques for manipulating algebraic expressions – procedures – remain important, especially for students who may continue their study of mathematics in a calculus program. Utilization of algebraic procedures includes understanding and applying properties of numbers and operations, using symbols and variables appropriately, working with expressions, equations, and inequalities, and solving equations and inequalities.

4.4 Data Analysis, Probability, and Discrete Mathematics

Students will develop an understanding of concepts and techniques of data analysis, probability and discrete mathematics and will use them to model situations, solve problems, and analyze and draw appropriate inferences from data.

A. Data Analysis or Statistics

In today's information based world, students need to be able to read, understand, and interpret data in order to make informed decisions. In the early grades, students should be involved in collecting and organizing data, and in presenting it using tables, charts, and graphs. As they progress, they should gather data using sampling, and should increasingly be expected to analyze and make inferences from data, as well as to analyze data and inferences made by others.

B. Probability

Students need to understand the fundamental concepts of probability so that they can interpret weather forecasts, avoid unfair games of chance, and make informed decisions about medical treatments whose success rate is provided in terms of percentages. They should regularly be engaged in predicting and determining probabilities, often based on experiments (like flipping a coin 100 times), but eventually based on theoretical discussions of probability that make use of systematic counting strategies. High school students should use probability models and solve problems involving compound events and sampling.

C. Discrete Mathematics – Systemic Listing and Counting

Development of strategies for listing and counting can progress through all grade levels, with middle and high school students using the strategies to solve problems in probability. Primary students, for example, might find all outfits that can be worn using two coats and three hats, middle school students might systematically list and count the number of routes from one site on a map to another; and high school students might determine the number of three person delegations that can be selected from their class to visit the mayor.

D. Discrete Mathematics – Vertex Edge Graphs and Algorithms

Vertex-edge graphs, consisting of dots (vertices) and lines joining them (edges) can be used to represent and solve problems based on real-world situations. Students should learn to follow and devise lists of instructions, called algorithms, and use algorithmic thinking to find the best solution to problems like those involving vertex-edge graphs, but also to solve other problems.

4.5 Mathematical Processes

Students will use mathematical processes of problem solving, communication, connections, reasoning, representations, and technology to solve problems and communicate mathematical ideas.

A. Problem Solving

Problem posing and problem solving involve: 1. examining situations in mathematics, other disciplines, and in common experiences, 2. describing these situations mathematically, 3. formulating appropriate mathematical questions, and 4. using a variety of strategies to find solutions. Through problem solving students experience the power and usefulness of mathematics. Problem solving is interwoven throughout the grades to provide a context for learning and applying mathematical ideas.

- Learn mathematics through problem solving, inquiry, and discovery.
- Solve problems that arise in mathematics and in other contexts.
    - Open-ended problems
    - Non-routine problems
    - Problems with multiple solutions
    - Problems that can be solved in several ways
- Select and apply a variety of appropriate problem solving strategies to solve problems
- Pose problems of various types and levels of difficulty
- Monitor students' progress and reflect on the process of their problem solving activity
- Distinguish relevant from irrelevant information and identify missing information

B. Communication

Communication of mathematical ideas involves students' sharing their mathematical understandings in oral and written form with their classmates, teachers, and parents. Such communication helps students clarify and solidify their understanding of mathematics and develop confidence in themselves as mathematical learners. It also enables teachers to better monitor student progress.

- Use communication to organize and clarify mathematical thinking
    - Reading and writing
    - Discussion, listening, questioning
- Communicate mathematical thinking coherently and clearly to peers, teachers, and others, both orally and in writing
- Analyze and evaluate the mathematical thinking and strategies of others

C. Connections

Making connections involves seeing relationships between different topics, and drawing on those relationships in future study. This applies to 1. mathematics, so that students can translate readily between fractions and decimals, or between algebra and geometry; 2. other content areas, so that students understand how mathematics is used in sciences, the social science, and the arts: 3. the everyday world, so that students can connect school mathematics to daily life.

- Recognize recurring themes across mathematical domains (i.e. patterns in number, algebra, geometry)
- Use connections among mathematical ideas to explain concepts (i.e. two linear equations have a unique solution because the lines they represent intersect at a single point)
- Recognize that mathematics is used in a variety of contexts outside of mathematics
- Apply mathematics in practical situations and in other disciplines
- Trace the development of mathematical concepts over time and across cultures.
- Understand how mathematical ideas interconnect and build on one another to produce a coherent whole

D. **Reasoning**

Mathematical reasoning is the critical skill that enables a student to make use of all other mathematical skills. With the development of mathematical reasoning, students recognize that mathematics makes sense and can be understood. They learn how to evaluate situations, select problem-solving strategies, draw logical conclusions, develop and describe situations, and recognize how those solutions can be applied.

- Recognize that mathematical facts, procedures and claims must be justified
- Use reasoning to support mathematical conclusions and problem solutions
- Select and use various types of reasoning and methods of proof
- Rely on reasoning, rather than answer keys, teachers, or peers, to check the correctness of problem situations
- Make and investigate mathematical conjectures
    - Counter examples and a means of disproving conjectures
    - Verifying conjectures using informal reasoning or proofs
- Evaluate examples of mathematical reasoning and determine whether they are valid

E. Representations

Representations refers to the use of physical objects, drawings, charts, graphs, and symbols to represent mathematical concepts and problem situations. By using various representations, students will be better able to communicate their thinking and solve problems. Using multiple representations will enrich the problem solver with alternative perspectives on the problem. Historically, people have developed and successfully used manipulatives (concrete representations such as fingers, base ten blocks, geoboards, and algebra tiles) and other representations (such as coordinate systems) to help them understand and develop mathematics.

- Create and use representations to organize, record, and communicate mathematical ideas.
    - Concrete representations (manipulatives)
    - Pictorial representations (diagrams, charts, or tables)
    - Symbolic representations (formulas)
    - Graphical representations (graph)
- Select, apply and translate among mathematical representations to solve problems
- Use representations to model and interpret physical, social, and mathematical phenomena

F. Technology

Calculators and computers need to be used along with other mathematical tools by students in both instructional and assessment activities. These tools should be used, not to replace mental math and paper and pencil computational skills, but to expand understanding of mathematics and the power to use mathematics. Students should explore both new and familiar concepts with calculators and computers and should also become proficient in using technology as it is used by adults (i.e. for assistance in solving real world problems).

- Use technology to gather, analyze, and communicate mathematical information
- Use computer spreadsheets, software and graphing utilities to organize and display quantitative information
- Use calculators as problem solving tools
- Use computer software to make and verify conjectures about geometric objects
- Use computer based laboratory technology for mathematical applications in the sciences

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Adopted Materials

Grade Level	Publisher	Title	Copyright Date	Date of Adoption
K	Pearson	Investigations in Number, Data, and Space-grade K	2008	June, 2009
1	Pearson	Investigations in Number, Data, and Space- grade 1	2008	June, 2009
2	Pearson	Investigations in Number, Data, and Space-grade 2	2008	June, 2009
3	Pearson	Investigations in Number, Data, and Space-grade 3	2008	June, 2009
4	Pearson	Investigations in Number, Data, and Space-grade 4	2008	June, 2009
5	Pearson	Investigations in Number, Data, and Space- grade 5	2008	June, 2009
6	Pearson	Connected Math 2- grade 6	2009	June, 2009
7	Pearson	Connected Math 2- grade 7	2009	June, 2009
8	Pearson	Connected Math 2- grade 8	2009	June, 2009
Accelerated 8	Glencoe	Algebra 1, Applications and Connections – Course 2	2001	June, 2003