Montgomery County Public Schools
Secondary Mathematics Curriculum Framework
(Original Pre-K–12 Version Approved July 2001; Updated Elementary Version Approved December 2010)

Goal

The goal of the Montgomery County Public Schools (MCPS) Pre-K–12 Mathematics program is for all students to achieve mathematical proficiency by developing both conceptual understanding and procedural fluency. The end result is the ability to think and reason mathematically and use mathematics to solve problems in authentic contexts.

Enduring Understandings

- Mathematics is the study of patterns and relationships.
- Mathematics is a language consisting of carefully defined terms and symbols.
- Mathematics is a tool used to solve problems in everyday life.
- Technology influences the mathematics that is taught and essential for our world.

Content

The MCPS Secondary Mathematics Curriculum Framework fully incorporates the Common Core State Standards (CCSS) for Mathematics in Grades 6–8 and high school courses. With a previous adoption of CCSS in elementary grades, the full progression of learning outcomes is documented for all grades.

Mathematics is a tool we use to understand and interpret our world. In our increasingly technological economy, those who can understand and apply mathematics have significantly enhanced opportunities to achieve success in continuing education and in life. The key to opening the door to these opportunities is a deep understanding of important mathematical concepts and procedures.

The integration of both mathematics concepts and processes is essential for meaningful understanding of mathematics. In the MCPS secondary mathematics framework, the concepts of mathematics are organized under the following strands/categories:

- Middle School: Ratios and Proportional Relationships, The Number System, Expressions and Equations, Functions, Geometry, and Statistics and Probability
- High School: Number and Quantity, Algebra, Functions, Modeling, Geometry, and Statistics and Probability

These concepts are developed through the eight Standards of Mathematical Practice:

- Make sense of problems and persevere in solving them.
- Reason abstractly and quantitatively.
- Construct viable arguments and critique the reasoning of others.

- Model with mathematics.
- Use appropriate tools strategically.
- Attend to precision.
- Look for and make use of structure.
- Look for and express regularity in repeated reasoning.

The mathematical content must be coherent and vertically articulated across the grades.

- In the elementary school years, students develop proficiency with number concepts and operations. For this to occur, students' experiences with the concept of numbers must be connected to mathematical concepts in geometry, algebraic reasoning, and data analysis. At the same time, proficiency with mathematical facts and skills must be developed so that students are facile in their application of mathematics to solve problems.
- In the middle grades, students extend their mathematical proficiency through their work with rational numbers, proportional reasoning, geometry, measurement, and data analysis. They continue the development of a deep understanding of important algebraic and geometric concepts as well as mathematical ways of thinking. The expectation is for all students to be successful in the formal study of algebra and other academically challenging mathematics courses.
- In high school, all students pursue rigorous mathematics coursework that enables them to see the connections among algebra, geometry, statistics, and discrete mathematics. Students must be able to visualize, represent, and analyze situations within the discipline as well as in other areas using mathematical terms.

Instructional Approach

Learning with understanding is essential for developing mathematical proficiency. According to the National Research Council's report *Adding It Up*, mathematical proficiency implies expertise in handling mathematical ideas. Students with mathematical proficiency understand basic concepts, are fluent in performing basic operations, reason clearly, formulate, represent, and solve mathematical problems, and maintain a positive outlook toward mathematics (Kilpatrick, 2001). These components of mathematical proficiency are interwoven and interdependent. Instruction in high school mathematics must help students refine and extend previously learned strategies for working with numbers and operations to more complex operations and concepts. The interdependence and connections among mathematical concepts and processes fosters the development of mathematical proficiency. Students must be actively engaged in learning experiences that are designed to deepen, connect, and build on students' knowledge. Communication is an essential part of mathematics education. Mathematics has many words and symbols that are unique to the discipline. Instruction must provide students with opportunities for speaking, reading, writing, representing, and listening in mathematics classrooms so that they will learn to communicate mathematically (Principles and Standards for School Mathematics, 2000). Technology is a tool for investigation and problem solving that enhances learning of mathematics and actively engages students. The use of technology should support the development of mathematical proficiency.

Mathematics teaching and learning must be challenging and rigorous with an emphasis on reasoning and problem solving. The development of logical reasoning is an essential component in learning mathematics. The logical reasoning inherent in the study of mathematics allows for applications to a variety of situations in which solutions to problems can be found with accuracy (California Math Standards). The curriculum makes a distinction between problem-solving as a general process and the solution of specific word problems that demonstrate application of mathematical skills. A mathematical problem is something that students do not already know how to do. Problem solving is the process of transforming something that students do not know how to do into something familiar (Steen, 1997). The mathematical problem-solving situations that students encounter should include problems that require broader thinking than traditional word problems demand (Burns, 1992). The mathematical problem-solving situations that students encounter should include problems that require broader thinking than traditional word problems demand (Burns, 1992). Word problems are a means for practicing computation. For example, a traditional word problem might ask: *How much change would you receive from a $10 bill if you spend $2.75*? The intent of this problem is to practice subtraction. Problem solving, on the other hand, should require students to develop a plan, execute the plan, and establish a purpose for learning to compute. For example, the previously cited word problem becomes a problem-solving situation when it is restated as follows: *Your change from a $10 bill when you spend $2.75 is $7.25. The digits in your change are the same as the digits in what you spent. What other amounts could you spend so that your change has the same digits?* (Burns, 1992). The problem situations that students encounter should extend their range of problem-solving strategies, deepen their mathematical understanding, and provide a meaningful context for learning mathematics. Problem solving must occur at every grade level and be the primary focus in mathematics instruction.

Differentiated instruction addresses student strengths, interests, and learning styles and should be paced to make the curriculum accessible to everyone. Flexible and varied grouping practices enhance the opportunity to receive expanded, intensive, enriched, and accelerated curriculum at all instructional levels as warranted by students' needs. A balance needs to be achieved so that all students have the opportunity to work in homogenous and heterogeneous groups. The curriculum is designed so that all students have the necessary skills and understanding for success in college or career mathematics. The pathway for students to take Calculus in high school or college is clearly laid out in the high school sequence of courses. Differentiation and grouping practices must be implemented to ensure that all students in both honors and regular courses are prepared for the next level of study in mathematics.

Assessment is an ongoing process that guides instruction and monitors student progress to include mastery of mathematics content and higher-level thinking skills. Preassessment, formative, and summative assessments provide for student, peer, and teacher evaluation. These types of assessment enable teachers to modify their instruction to support improved learning at each grade level for all students. Assessment should be focused on the development and achievement of mathematical proficiency (Kilpatrick, 2001).

Documents and Concepts Considered in this Framework

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