



Elementary Math Curriculum: *Get the Facts!*

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Get the Facts! provides current information for staff, parents, and the community about the elementary math curriculum taught in Frederick County Public Schools. Learn more at www.fcps.org.

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ELEMENTARY MATH IN FREDERICK COUNTY PUBLIC SCHOOLS

1. What are FCPS' goals for students, and why is math so important?

Our goal is to provide an exceptional mathematics program that ensures that students develop conceptual understanding, computational fluency, and problem solving skills. We know that a healthy balance between the basic skills and conceptual understanding is necessary for students to transfer their skills and knowledge to new situations. We want students to achieve at the highest level at the same time they are developing confidence in themselves as lifelong learners. We want to eliminate achievement gaps among student subgroups while maintaining high expectations for all students.

Mathematical understanding is critically important for our 21st century students. The world they are entering is vastly different from the world of their parents and grandparents, who had no calculators, personal computers, iPods, Internet, and cell phones when they were growing up. Therefore, our students' learning opportunities and experiences must also be different to help them meet the challenges they will face.

2. Has the elementary math curriculum changed?

Although some of the resources and strategies teachers use are different, the essential curriculum for elementary mathematics *has not changed* except for a few minor changes to align with state standards. The essential curriculum for mathematics can be found in the elementary math section under the *Academics* tab at www.fcps.org and at <http://www.fcpsteach.org/math/elem/default.cfm>.

The essential curriculum includes a carefully sequenced set of standards (PreK-12) that include:

- **Number Relationships and Computation**—Numbers and computation are the heart of elementary mathematics. Children develop conceptual understanding, procedural proficiency, and fluency with numbers. Throughout PreK-grade 5 they work with:
 - Whole number and computation with whole numbers
 - Recall of math facts including multiplication table facts
 - Standard algorithms (+, x, -, /) for computation of whole numbers
 - Fractions, decimals, and computation with fractions and decimals
- **Algebra, Patterns, and Functions**—Students generalize the patterns of numbers and computation using symbols to prepare for algebra and abstract mathematics after elementary school.
- **Geometry**—Students learn about the properties and relationships of points, lines, angles, surfaces, and solids. They develop skills and concepts in shape and spatial relationships.
- **Measurement**—Students select appropriate measurement units, tools, and strategies, and use them to measure. Measurement and geometry provide many connections to real world applications.
- **Statistics**—Students learn how to collect, organize, describe and analyze data, all important skills in our data-rich world.
- **Probability**—Children explore the likelihood of events through simple experiments.
- **Processes of Mathematics**—Children develop skills in problem solving, reasoning, communicating, and making connections.

3. Why does math today look different from the math we were taught?

This is a good question and one that parents and community members frequently ask. In the past, mathematics focused on memorizing facts and on methods for solving problems. Homework usually consisted of 10-20 computation problems. Students believed that they were good in math if they could do it quickly, even if they didn't understand what they were doing. Few students went on to study higher mathematics or other scientific fields requiring mathematics, and others experienced failure when they had to take a required mathematics course in college.

The basics are changing. Arithmetic skills are still necessary, but students must now understand algebra, geometry, statistics, probability, and a wide array of business applications before graduating from high school. Today's workplace demands workers who can solve problems, explain their thinking and reasoning to others, analyze data and trends, and use modern technology.

Nationwide, teachers place much greater emphasis on thinking and understanding. Because of this increased emphasis, the most recent 2007 mathematics results on the National Assessment of Educational Progress (NAEP) for 4th graders were higher than in any previous assessment and 27 points higher than the first assessment administered in 1990.

4. Why is the language used in math different than when I was in school?

Most math language hasn't changed. However, some language is introduced earlier so that students can learn to communicate clearly and accurately. For example, since students are expected to learn about shape at an earlier age, they learn the vocabulary used to describe shapes (like "vertex," "face," "rotation") earlier. Another example is use of the term "rhombus" rather than the non-mathematical term "diamond." Children often refer to the shape as a "diamond" because they have seen diamond shapes in their world, but we encourage them to begin to use the mathematics term "rhombus."

Some mathematics terminology has changed in order to bring meaning to the concept behind the terminology. For example, "borrow" and "carry" do not convey what is really happening in the process of subtracting and adding. Instead we use "regroup" or "rename" to show that the numbers involved don't change but what changes is the grouping or naming of the numbers. This helps teachers connect the values of the numbers with the computation algorithm (not simply the digits). For example, in the problem $45 - 27$, when students find they cannot subtract 7 from 5, we want them to think of 45 as 4 tens and 5 ones, which can also be regrouped as 3 tens and 15 ones. Now students can perform the subtraction $15 - 7$. Another example is the use of the phrase "multi-digit division" in place of the phrase "long division" in order to better explain the strategy.

5. How well do FCPS students perform in math on state assessments?

The state assessments are an important check for parents. Proficiency on the Maryland School Assessment (MSA) means that the child has achieved mastery of Maryland's Voluntary State Curriculum that details what every student should know at each grade level. The FCPS Essential Curriculum is aligned to the state curriculum.

FCPS elementary students perform very well on the Maryland State Assessments (MSA) and consistently score above the state average.

	FCPS % Proficient		Maryland % Proficient	
	<u>2007</u>	<u>2008</u>	<u>2007</u>	<u>2008</u>
Grade 3	83%	87%	78%	82%
Grade 4	89%	93%	86%	88%
Grade 5	81%	84%	78%	80%

FCPS secondary students also perform well above state and national averages on the SAT.

	FCPS <u>2008</u>	Maryland <u>2008</u>	Nation <u>2008</u>
SAT Math	524	502	515
SAT Reading	509	499	502
SAT Writing	<u>506</u>	<u>497</u>	<u>494</u>
Combined	1539	1498	1511

INVESTIGATIONS MATH TEXTBOOK

1. What is *Investigations*?

In April 2008, the Board of Education approved a new textbook for mathematics grades K-5: *Investigations in Number, Data, and Space, 2nd Edition*, published by Pearson Scott Foresman. *Investigations* is a well-researched text resource with model lessons that build concepts from one lesson to another.

The *Investigations* text focuses on actively engaging children in learning mathematics. It provides well researched activities and investigations that engage students in meaningful activities, discussions and problem solving.

One of the text's strengths is that it develops the skills that lead to proficiency in higher mathematics. The textbook series focuses heavily on computational fluency, which is the ability to accurately, efficiently and flexibly compute (both mentally and with paper and pencil). This approach to computation sets a much higher standard of understanding of number and operation than most math texts. It also prepares students for success in higher levels of math because these mathematical understandings and strategies are the foundation for Algebra.

After more than two decades of use in other school districts and significant research on its use by the National Science Foundation (NSF) and others, *Investigations, 2nd Edition*, is one of the most studied, revised, and improved texts available to schools today. It is vastly different from the *1st Edition* that was the subject of early criticism in the math world.

2. What process did FCPS use to select *Investigations*?

In 2007, FCPS began the textbook review process in accordance with FCPS regulations and procedures. Teachers, mathematics curriculum specialists and supervisors looked for a textbook that would better support the FCPS essential curriculum, Maryland's Voluntary State Curriculum (VSC), the recommendations of the FCPS audit and recommendations of national experts for improving math instruction. They considered the recommendations in the *Curriculum Focal Points* document of the National Council of Teachers of Mathematics (NCTM) and preliminary recommendations of the National Mathematics Advisory Panel (NMAP), which emphasized the need to give students an early start and emphasize conceptual understanding, computational fluency and problem-solving skills.

A committee of teachers, parents and administrators reviewed nine texts using these five criteria:

1. Mathematics content, especially alignment with FCPS curriculum, Maryland VSC, NCTM, and NMAP recommendations
2. Instructional focus and strength of support to teachers in assessing and meeting the needs of a wide range of students
3. Support for teachers, both in terms of resources for instruction and understanding mathematics content, pedagogy, and student learning
4. Informational materials for parents
5. Research supporting the use of the text for grades K-5

The committee selected two texts (*Envision Mathematics* and *Investigations, 2nd Edition*) for field testing in classrooms in six Frederick County elementary schools during the 2007-08 school year. One of the schools included in the field test was Lincoln Elementary School, which had used the text since 2003 as part of a collaborative agreement for school improvement between FCPS and the Maryland State Department of Education. Parents were informed of the field test of the texts in the classrooms. During the field test, the committee reviewed information from surveys, focus groups, field observations, and recommendations from teachers and principals.

After carefully reviewing all field test information from the six schools and achievement results from schools already using the text, the associate superintendents with responsibility for curriculum and elementary instruction recommended approval of *Investigations, 2nd Edition* for use in FCPS classrooms.

The associate superintendents (both with math degrees and experience teaching math), along with the Director of Curriculum, the Elementary Mathematics Curriculum Specialist, and the Secondary Mathematics Curriculum Specialist, recommended *Investigations* because it met the established criteria and provided a consistent, research-based approach to mathematics instruction.

Investigations was placed in public libraries for public review and comments. No comments were received. The Board of Education approved the selection at its April 23, 2008 meeting. The Board reaffirmed its approval at its June 25, 2008 meeting.

3. How is *Investigations* being implemented?

FCPS introduced *Investigations* in kindergarten, grade 2 and grade 4 in the 2008-09 school year. Grades 1, 3, and 5 will begin using *Investigations* during the 2009-10 school year. The text is also available for use in the Gifted & Talented Magnet Program along with a variety of other resources. Teachers use the textbook as a primary resource for planning, teaching, and implementing quality instruction.

Implementation was planned to occur over two years in order to provide time for teachers to receive training in using the new text materials. Ongoing feedback from teachers and principals has already and will continue to guide staff in adjusting and improving instruction.

The use of one primary text for K-5 mathematics provides a consistent resource between teachers in a single grade, among teachers from one grade to the next, and from one school to the next. This ensures a well articulated, consistent program of instruction that will benefit students who move from teacher to teacher throughout elementary schools. It will also benefit teachers as they collaborate to provide the best possible instruction to FCPS students.

4. Why was the *Investigations* math text selected?

In our field test, *Investigations* was shown to provide the strongest curriculum alignment, instructional focus, and resource materials to support teachers in teaching the FCPS essential curriculum to a wide range of learners. FCPS teachers strongly endorsed the text because it provides the resources to ensure active learning experiences and detailed information about mathematics content, methodologies, and student learning. We also were impressed with the quality of the informational materials designed for parents and families and its record of successful implementation in many school districts. In addition, *Investigations* develops students' problem-solving and reasoning skills to prepare them for higher levels of mathematics study, beginning with algebra and continuing through pre-calculus and calculus in high school.

5. How does *Investigations* differ from other math texts?

Investigations is not a typical hard-bound math textbook. It has student practice workbooks, guided practice worksheets, and investigations and games that support practice and automatic use of math facts along with time to develop problem-solving skills. Students still use paper and pencil to develop and practice their mathematical understanding. They also use extensively their visual, auditory, and tactile senses to help their minds build conceptual understanding and number sense.

Students develop mathematically through hands-on experiences using concrete objects such as math manipulatives (interlocking cubes, blocks, pattern pieces, colored chips, links, etc.). They are expected to pictorially (draw or diagram) their ideas. And finally, they abstractly (in theory, without thinking of a specific object) demonstrate their understanding with words and mathematical symbols.

In addition, students often keep their work in a notebook so they can refer to their explanations, data, solutions and strategies. A student math handbook is designed to be used at home by families as they support the math learning of their children.

6. Are students expected to memorize basic math facts and do computations with standard algorithms?

Absolutely! A student’s ability to mentally calculate and use basic math facts is a critical skill in our technological world. Students develop automatic recall of math facts throughout the elementary grades.

Teachers use *Investigations* fact cards as well as other resources, including the guide developed by FCPS, *Basic Math Facts: A Sequence of Learning*. Teachers also continually assess math facts using *Investigations* as well as the FCPS *Facts Testing Package* that includes multiple forms of timed tests for the facts expected at each grade level. A software intervention program, *FASTT Math*, helps students with math fact recall.

Investigations uses standard algorithms (mathematical rules or procedures for solving problems), non-standard algorithms, and student-invented algorithms to increase student understanding of number sense, place value, and number properties. However, the standard pencil-paper algorithms for whole-number computation still play an important role in mathematics instruction.

We use formative and summative assessments to monitor students’ basic math facts mastery and whole number computation using standard algorithms.

7. What mental math and computation do students learn in each grade level?

FCPS Goal – By the end of each grade level, students will be able to:	
K	<ul style="list-style-type: none"> • Identify numbers 0-31 • Add and subtract numbers 0-9 using counting strategies
1	<ul style="list-style-type: none"> • Identify numbers 0-100 • Add and subtract 1-digit numbers using a variety of increasingly efficient strategies
2	<ul style="list-style-type: none"> • Identify numbers 0 – 1,000 • Quickly recall addition and subtraction facts 0-10 • Use mental computation to determine reasonableness of sums and differences • Add and subtract 2-digit numbers using a variety of increasingly efficient strategies • Add and subtract 2-digit numbers mentally
3	<ul style="list-style-type: none"> • Identify numbers 0 – 10,000 • Quickly recall addition and subtraction facts 0-10 • Use mental computation to determine reasonableness of sums and differences • Add and subtract 3-digit numbers using a variety of increasingly efficient strategies • Add 3-digit numbers using the standard U.S. algorithm • Multiply and divide a 2-digit by a 1-digit number using a variety of increasingly strategies
4	<ul style="list-style-type: none"> • Identify numbers 0 – 1,000,000 • Quickly recall addition, subtraction, multiplication, division facts 0-10 • Mentally compute approximate sums, difference, products, and quotients • Use mental computation to determine reasonableness of sums, differences, products and quotients • Add and subtract 4-digit numbers using a variety of increasingly efficient strategies • Add and subtract 4-digit numbers using the standard U.S. algorithm • Multiply and divide a 3-digit by a 1-digit number using a variety of increasingly efficient strategies • Multiply a 3-digit by a 1-digit number using the standard U.S. algorithm
5	<ul style="list-style-type: none"> • Quickly recall addition, subtraction, multiplication, division facts 0-10 • Mentally compute approximate sums, difference, products and quotients • Use mental computation to determine reasonableness of sums, differences, products and quotients • Multiply a 3-digit and divide a 4-digit by a 2-digit number using a variety of increasingly efficient strategies • Multiply a 3-digit and divide a 4-digit by a 2-digit number using the standard U.S. algorithms

8. Do teachers pace math instruction to the needs of individual students?

Differentiating instruction can be challenging for teachers. Math teacher specialists meet regularly with teams of teachers to determine how best to pace lessons and help develop plans for students who are not achieving or not sufficiently challenged. We know that students require individualized solutions to learn our essential curriculum, no matter what curricular resources are being used by the teacher.

Investigations offers much better resources than ever to help teachers reach all students. Teachers use guides called “curriculum maps” to connect and relate the variety of available instructional materials to the math program. Since the maps are paced for teachers who are experienced using the text and curriculum, a less experienced teacher may move instruction at a slower pace the first year than in subsequent years.

Sample supplemental lessons written by master teachers give less experienced teachers ideas on how to best utilize the materials. Ultimately — because they are qualified, trained professionals — our teachers use these resources as guides, and they themselves write the lessons and decide what materials will ensure success for all students. We plan to do even more during summer workshops this year to strengthen these resources.

9. What other instructional resources do teachers use?

Because instruction must be tailored to the needs of diverse learners and no single resource can be single “answer,” FCPS provides teachers an extensive set of resources to teach elementary mathematics. *Investigations* serves as the primary text resource, but other important resources include manipulatives, software programs, supplemental text resources, and curricular resources created and shared by expert FCPS teachers.

For example, every school has *Number Worlds* or *Exploring Math* and *FASTT Math* software, resources designed to support students who struggle with initial instruction in key concepts. A comprehensive program called *Basic Math Facts: A Sequence of Learning* provides full support for teaching basic math facts to all students; it is available online at www.fcpsteach.org. A selection of resource books, including titles such as *Number Sense*, *Nimble with Numbers* and *20 Thinking Questions for Linking Cubes*, provide teachers additional instructional activities to incorporate into lessons.

10. What professional development do teachers receive?

Teachers receive a full day of training in August and January and also participate in regular sessions at their school to review the curriculum resources:

- Detailed curriculum charts that identify objectives, recommended pages to use in the new text and other approved resources, vocabulary, math facts to be mastered, assessments, classroom routines, and a recommended timeline
- Approved text resources from *Investigations*
- Student text materials for class work and homework
- Teacher text resources for math concepts and instructional strategies

11. What other districts in Maryland use *Investigations*?

More than half of the districts in Maryland have approved the use of *Investigations* or a similar text, *Everyday Math*, for mathematics instruction in grades K-5. *Investigations* is the primary text resource for Frederick County, St. Mary’s County, and Baltimore County. Other counties that use *Investigations* or *Everyday Math* are Baltimore City, Caroline, Carroll, Charles, Harford, Howard, Kent, Montgomery, Queen Anne’s and Talbot.

12. How is FCPS evaluating the effectiveness of *Investigations*?

We are monitoring students':

- Demonstrated mastery on formative assessments
- Achievement on the summative Maryland School Assessment (MSA) in grades 3-5
- Achievement on daily classroom assignments

We also collect feedback from principals, teachers, students, and parents, so the staff can effectively adjust instruction to meet the needs of our students.

13. How is FCPS adjusting instruction in response to concerns identified in the first year?

After discussions and meetings with teachers, teacher specialists for mathematics, assistant principals, and principals during the first year of using *Investigations*, we identified areas for adjustment and improvement.

- Principals have received detailed instruction guidelines that we will update throughout the school year as we identify new strategies and best practices.
- Professional development is being provided to assist teachers in organizing instruction in the mathematics classroom. Teachers will now use many of the same strategies in the mathematics block that work well for the language arts block. They will work with their teammates, math teacher specialist, math curriculum specialist, professional development teacher specialist, and building administrators to develop strategies for effective organization and management.
- We are identifying and developing new instructional resources to appropriately support and challenge all students. Differentiating lesson strategies has always been a challenge for teachers but especially so when a new text resource is introduced.
- Next school year, teachers will use new assessment tools to more carefully monitor student progress and more quickly fine tune instruction. Regular feedback to parents will help them better understand their children's progress.
- Teachers will carefully select homework assignments and accompany it with clear directions so parents can be effective partners in their child's learning.
- We plan additional parent meetings for the upcoming school year, at both the local school and regional sites.

We know that there is no single best resource to teach mathematics. It all comes down to the teachers — they are the ones who make the critical difference in the classroom. The changes we are making this year and next will support our excellent teachers in the use of new text materials and new curricular unit plans.

14. Why has *Investigations* math generated controversy?

Change in mathematics instruction has always generated controversy. Some disagree with the FCPS elementary math program that includes a balance of conceptual understanding, computational fluency, and problem solving. Instead they believe that:

- Elementary-level math should be practice of traditional arithmetic computation
- Math problems should be solved quickly
- Technology, including calculators, should not be used in mathematics instruction
- Teachers should not confuse students with discussions of strategies and solutions

These beliefs, however, are not consistent with the research-based teaching and learning envisioned in the National Council of Teachers of Mathematics' *Principles and Standards for School Mathematics* (2000), the National Research Council's *Adding It Up* (2001) and *How Students Learn* (2005) or Maryland's Voluntary State Curriculum.

Many adults today graduated from high school at a time when only college-bound students were required to take algebra. That is no longer the case. In Maryland, all students must pass Algebra I and Geometry in order to graduate. Maryland's Voluntary State Curriculum includes multiple standards in addition to computation, including the standard on process and problem solving. The *Investigations* text (originally developed by the research group TERC) supports teachers and students in meeting all of these standards.

WHAT STUDENTS ARE LEARNING

1. What does a typical math class look like?

In the 21st century math classroom you will see students actively engaged in mathematics learning. They may be working in groups to investigate, discuss, and solve problems. They are often required to explain — in writing and verbally — their thinking and solutions to problems.

You will also see students developing strong skills in computation so they can accurately, efficiently, and flexibly compute using whole numbers as well as decimals, fractions, percent, time, money, etc. Students must have automatic recall of basic math facts in order to compute.

In the classroom, direct teacher instruction and guided student practice will develop computation strategies through such approaches as:

- a quick mental computation of an exact answer
- a quick mental estimate when an exact answer is not needed
- a sketched diagram to organize the information needed for the computation
- paper/pencil computation with standard algorithms such as:
 - addition with regrouping (sometimes referred to as “addition with carrying”)
 - subtraction with regrouping (sometimes referred to as “subtraction with borrowing”)
 - multiplication (sometimes referred to as “long multiplication”)
 - division (sometimes referred to as “long division”)
- other algorithms or methods

The National Mathematics Panel supports this development of computation skills since it sets the stage for subsequent success in algebra beginning in middle school. At each grade level in elementary and middle school, students further develop their strategic reasoning abilities as they develop fluency with each new application, especially as they begin studying the very abstract and symbolic mathematics of algebra and calculus.

2. Are students given sufficient practice time to master math concepts and applications?

Teachers plan their lessons to give students sufficient time to master concepts and applications. In addition to the main lesson, students have time during class to practice what they are learning. Research shows that practice must occur over time, not just during the initial lessons on computation. For this reason, practice is part of instruction practice throughout elementary school.

3. How are calculators and technology used in math instruction?

The FCPS essential curriculum requires that children learn how to do pencil-and-paper computations. However, it also requires students to appropriately use calculators, computers, scientific probes, etc. so they are adequately prepared for the technological demands of our global economy.

Numerous research studies have shown that the proper use of calculators can enhance cognitive skills in the areas of number sense, conceptual development, problem solving, and attitudes towards mathematics. The calculator is a tool for learning and applying mathematics, not a substitute for knowing mathematics. In fact, tests such as the Maryland School Assessment, High School Assessment, the SAT and PSAT/NMSQT, and Advanced Placement exams allow calculator use for some or all portions of the tests.

Teachers help students learn when to use a calculator, paper and pencil, or mental math to solve a problem. Our goal is for students to become fluent in making decisions about which approach to use for different situations.

4. How do the language skills of young children impact their ability to learn math?

Mastery of language is essential for young children in their study of all subjects, including mathematics. *Investigations* helps develop thinking and language skills. The curriculum charts that teachers use for every unit include critical vocabulary. *Investigations'* emphasis on having children communicate their understanding both orally and in writing helps develop language skills as well as math understanding.

5. Does the FCPS elementary mathematics instruction prepare students to study algebra in middle school and higher level mathematics in high school and beyond?

Yes! In grades K-5 they develop the knowledge, skills and conceptual understanding to succeed in advanced mathematics beginning with algebra in middle school.

Each year, students study an entire unit on algebra, patterns, and functions. However, algebra connections are made throughout the year in order to help students generalize their ideas about numbers and computation.

This study prepares them for the abstract concepts of algebra and other advanced mathematics courses. Students who enter grade 6 in the 2010-11 school year will have used the text resource *Investigations* during 4th and 5th grade. In addition to two full years of fundamental math skills, they will also have learned to explain and justify their understanding of mathematical concepts and be better prepared than students before them for the abstract reasoning required in Algebra I.

Students who enroll in Honors Math 6 will study Algebra I either in grade 7 or grade 8. Students who enroll in 6th grade Merit will study Pre-algebra in grade 8 and Algebra I in grade 9.

To ensure alignment and a smooth transition between elementary and middle school mathematics instruction, 6th grade mathematics teachers work with 5th grade teachers during the summer essential curriculum workshop to develop curriculum unit guides for grade 5.

PARENTS' ROLE AND RESOURCES

1. How can parents help support their children and learn more?

Parents are encouraged to talk to their children about what they are learning in school. They can also support their children by setting aside a place and time for their child to complete assigned homework.

Homework may consist of 5-10 practice problems, or it may only be one or two problems that asks students to show how they solved the problem. A homework assignment may require the child to play a game that helps develop skills and efficient strategies.

You can help your child get started on problems by asking:

- Can you describe the problem in your own words?
- What are your ideas so far?
- Does this remind you of any other problems you've done?
- Where are you thinking about starting?
- What is the problem asking you to do?
- Would a drawing help?
- For math games — Can you teach me the rules? What strategies are you using?

If your child becomes frustrated after having worked for a reasonable amount of time on the problem, stop the homework session and send a note to the teacher explaining the child's difficulty and asking for suggestions.

2. What should parents do if their child is struggling to learn math?

Parents who are concerned about their child's progress in mathematics should always contact their child's teacher. The teacher knows the curriculum and the child's progress towards mastery of the curriculum. Additional concerns can be addressed with the principal.

3. Does FCPS offer math resources for parents?

Each homework page has a book bag symbol in the top right corner that includes a reference to the page in the Student Math Handbook. This handbook provides both the student and the parent information on the concept and skill being developed. The paper version of the handbook is sent home to assist with homework. It is also available online for students and parents along with grade level software. Ask your child's teacher for more information on these resources.

Parent meetings were held at many schools during the school year for families to learn more about how their children are learning mathematics and ways families can work with educators to support their child's learning. The text *Investigations* is available in each elementary school media center as well for parents to review.

Regional informational meetings for parents are planned for the 2009-10 school year, along with opportunities at individual schools for families to learn more about how their children are learning mathematics and ways families can work with educators to support learning.

At any time during the school year, parents should feel free to discuss concerns with the teacher. In addition, parents and members of the community who have questions about math instruction and our curriculum are encouraged to visit www.fcps.org/mathfacts.

APPENDIX

1. Investigations Studies in the U.S.

FCPS field-test data in 2008 indicated that FCPS teachers in 19 classrooms and principals of the three schools found the *Investigations* materials an improvement over current materials to implement the FCPS curriculum in elementary mathematics:

- Teachers expressed a desire to continue use of *Investigations* as a resource
- Teachers shared that the materials were effective in planning mathematics lessons using our curriculum
- Principals stated that teachers were able to plan successful lessons using the materials
- Teachers and principals reported that the materials helped teachers produce lessons that engaged students actively in learning and increased motivation of students to study mathematics.
- Parents were informed of the use of *Investigations* as a resource in their child's classroom. None of the parents of the more than 400 children using the new text expressed any concerns throughout the field test.

St. Mary's County Maryland (20,000 students) began using *Investigations* in 2003-04 and used an implementation model similar to the model FCPS is using:

- Like FCPS, their approach is to teach the Voluntary State Curriculum with *Investigations* as the primary text resource. Like FCPS they also have developed pacing guides, curriculum maps, and county assessments that assess VSC objectives. Our curriculum staff has shared ideas and resources with SMCPs curriculum staff.
- The superintendent said parents are most concerned about computational fluency being taught in a way they don't recognize and fear that the lack of emphasis on learning standard algorithms will impact students negatively in middle school. As a result, they have worked with teachers to ensure that computation is explicitly taught, as we are doing. He also says that they teach standard algorithms (now included the newest edition of *Investigations* that FCPS adopted) "so that students can choose the method that is most efficient for them—this is in accordance with the NCTM Focal Points."
- They use the text as a resource rather than as a curriculum, as does FCPS.
- They use curricular unit plans that explicitly state the algorithms to be taught, as do our teacher resources.
- Teachers have on-going, embedded professional development to help them integrate the new text resources with other available resources used to teach their curriculum.
- Dr. Michael Martirano, Superintendent, says that they have seen "continuous and sustained improvement on MSA scores in elementary since we began using *Investigations*." At the elementary level, the percent of students achieving proficiency increased and the advanced level of performance on the MSA in mathematics has more than doubled.

St. Mary's County Public Schools					
	Proficient			Advanced	
Grade	2003	2008		2003	2008
3	69%	88%		15%	34%
4	76%	92%		22%	50%
5	57%	86%		8%	33%

The middle school also saw rising proficiency levels as well as advanced levels of achievement that more than doubled since 2003.

St. Mary's County Public Schools					
	Proficient			Advanced	
Grade	2003	2008		2003	2008
6	53%	83%		12%	45%
7	48%	77%		7%	29%
8	40%	70%		8%	29%

ARC Center Tri-State Achievement Study:

In 2000, the ARC Center at COMAP in Lexington, Massachusetts received funding from NSF to carry out a large-scale study of the effects of several mathematics textbook series, including *Investigations* on state-mandated standardized tests in Massachusetts, Illinois, and Washington State. The principal finding of the study was that the achievement in mathematics for students using materials such as *Investigations* increased in all areas of elementary mathematics, including basic skills and higher-level processes.

Indiana University Study of the Revised *Investigations*:

As part of the NSF grant to revise *Investigations*, a subcontract was awarded to a team of researchers at Indiana University to conduct an evaluation study of the revised *Investigations*. Between 2002 and 2007, Indiana University conducted a longitudinal study focused on the content areas of number sense, computation, and algebraic reasoning. A comparison of achievement of students using the materials with the achievement using alternate, more traditional materials found that students studying with *Investigations* performed as well as or better than similar students using alternate materials.

Boston Public Schools

The school system began to use *Investigations* in 2002-03. After they began implementation, Boston students scoring at or above proficient on state testing in mathematics increased significantly. While reviewers did not attribute these increases to *Investigations*, as we recognize no text series solely determines student achievement, reviewers did note that students using these materials could successfully learn critical mathematics content.

2. History of Math Research in the U.S.

More than 25 years ago, several studies showed that U.S students were falling behind in mathematics in comparison to their peers worldwide:

- 1967 First International Mathematics Study
- 1981 Second International Mathematics Study
- 2001 Third International Mathematics Study

The responses to this crisis in mathematics led to series of national reports, research and actions:

- 1980 *Agenda for Action*, National Council of Teachers of Mathematics (NCTM)
- 1983 *A Nation at Risk*, National Commission on Excellence in Education
- 1989 *Everybody Counts: A Report on the Future of Mathematics Education*, National Research Council
- 1989 *Mathematics Curriculum and Evaluation Standards*, NCTM
- 1989 National Science Foundation provided research funding to develop *Investigations*
- 1995 Dale Seymour published *Investigations, 1st edition*
- 2000 *Before It's Too Late*, National Commission on Math/Science Teaching
- 2001 National Science Foundation provided research funding to revise *Investigations, 1st edition*
- 2001 *Adding It Up*, National Research Council
- 2006 *Curriculum Focal Points for PreK-Grade 8*, NCTM
- 2006 National Mathematics Advisory Panel established
- 2007 Pearson Scott Foresman published *Investigations, 2nd edition*
- 2008 *National Mathematics Advisory Panel Final Report*

The National Mathematics Advisory Panel Report had six key recommendations:

1. Math curriculum in grades PreK-8 should be streamlined and should emphasize a well-defined set of critical topics in the early grades
2. Use should be made of research that recognizes that (a) students need an early start, (b) curriculum must simultaneously develop conceptual understanding, computational fluency, and problem solving skills, and (c) effort, not just inherent talent, counts in math achievement.
3. Classroom teachers must have strong mathematics content knowledge
4. Instruction should be guided by high quality research and the professional judgment of experienced teachers. Instruction should be a balance of "teacher directed" and "student centered."
5. National Assessment of Educational Progress (NAEP) and state assessments should be improved in quality.
6. More rigorous research in education is needed to inform policy and practice.

The math text, *Investigations, 2nd Edition*, meets these instructional recommendations. *Investigations* was developed twenty years ago with National Science Foundation (NSF) funding using a rigorous development model of design, piloting, redesign, field testing, redesign, and publication. *Investigations, 2nd Edition* was published in 2007 after six years of NSF funded research to revise, refine, and improve the first edition.

3. National Reports

Everybody Counts (1989)

<http://www.nap.edu/openbook.php?isbn=0309039770>

Measuring Up (1993)

<http://www.nap.edu/openbook.php?isbn=0309048451>

America Counts—The U.S. Department of Education and National Science Foundation (1999)

<http://www.ed.gov/inits/Math/index.html>

National Assessment of Educational Progress: The Nation's Report Card

<http://nces.ed.gov/nationsreportcard/mathematics/>

US Department of Education Information on the National Mathematics Advisory Panel

<http://www.ed.gov/about/bdscomm/list/mathpanel/index.html>

Final Report of the National Mathematics Advisory Panel (2008)

<http://www.ed.gov/about/bdscomm/list/mathpanel/index.html>

***How People Learn: Brain, Mind, Experience, and School* (2000)**

http://www.nap.edu/catalog.php?record_id=9853

***Adding It Up: Helping Children Learn Mathematics* (2001)**

http://www.nap.edu/catalog.php?record_id=9822

***Helping Children Learn Mathematics* (2002)**

<http://www.nap.edu/openbook.php?isbn=0309084318>

4. Investigations Text Resources for Parents

- *Family Letters: About the Mathematics in this Unit* that introduces families to the mathematics their children will be doing
- *Related Activities to Try at Home* that suggest activities families can do together at home and children's books that support math learning
- *The Student Math Handbook* that provides an overview of mathematics being learned with directions for use at home

5. Websites for Parents

FCPS Mathematics Essential Curriculum

FCPS Basic Math Facts: A Sequence of Learning

<http://www.fcpsteach.org/math/elem/default.cfm>

Maryland PTA with Links for Parents

http://www.mdpta.org/bridge_links.html

The Math Forum Student Center

<http://mathforum.org/students/>

Math Dictionary for Kids

<http://www.amathsdictionaryforkids.com/>

NCTM

www.nctm.org

NCTM Family Resources

<http://www.nctm.org/resources/families.aspx>

NCTM Focal Points

<http://www.nctm.org/standards/content.aspx?id=270>

Helping Your Child Learn Mathematics, U.S. Department of Education

<http://www.ed.gov/parents/academic/help/math/index.html>

Helping Your Child Learn Mathematics, U.S. Department of Education (Spanish Version)

<http://www.ed.gov/espanol/parents/academic/matematicas/index.html>