Math Solutions
FOUNDED BY MARILYN BURNS

Math Solutions Professional Learning

AGENDA
Mathematical Practices Series™

Through the development of mathematical habits of mind, students are able to use mathematical knowledge and skills to make sense of and solve problems. This series aligns what educators already know with what they need to learn about developing students' processes and proficiencies in navigating through difficult or unknown mathematical territory. Participants leave each day of this three-day course with instructional skills and strategies they can use in their classrooms immediately.

Day One: Making Sense of Math—Reasoning and Discourse
Day Two: Mathematical Thinking—Representation and Procedural Fluency
Day Three: Problem Solving—Developing Disposition, Competence, and Confidence

FORMAT
This series is offered as a three-day institute or as individual courses over time.

DAY ONE: MAKING SENSE OF MATH—REASONING AND DISCOURSE

Among the highest priorities of current state standards is for students to build a deep understanding of mathematics and use that understanding to reason about problems, make sense of new learning, and communicate their thinking to others.

This day is designed to introduce participants to the essential habits of mathematical thinkers, with particular emphasis on the role of reasoning and discourse. During this course, participants engage in and examine the kinds of tasks that help students communicate about and make sense of important mathematical ideas, and discuss the implications for their students.

OUTCOMES
- Use strategies to help all students deepen and communicate their mathematical reasoning
- Identify the difference between social conventions of mathematics and mathematical knowledge that students need to make sense of for themselves
- Select tasks and use classroom discussions to develop students' mathematical habits of mind and to assess understanding

OPENING
This introduction includes the goals, an overview of the course, and pertinent logistical information. In addition, time is provided for the group to build a community for learning.

LOGICAL REASONING AND CLASSROOM DISCOURSE
Mathematically proficient students make sense of problems, reason abstractly and quantitatively, and are able to explain and justify mathematical ideas and arguments with precise mathematical language. During this session, participants focus on strategies to engage students in mathematical reasoning and discussions to communicate their reasoning. First, observing the instructor weave Talk Moves into the presentation, and then practicing using them, participants analyze the powerful influence of Talk Moves in developing students' reasoning skills and deepening their understanding.

HOW STUDENTS LEARN
When mathematical knowledge is based in logic, it requires students to interact with the knowledge in ways that help them uncover its meaning for themselves. In this session, participants develop an understanding of the standard formula for determining the circumference of a circle. Through this experience, they reflect on the conditions needed for students to make sense in order to develop understanding of mathematical ideas.

LUNCH

COMPARING MATHEMATICAL TASKS
The tasks teachers provide are the foundation for mathematics instruction that supports thinking, reasoning, and problem solving. In this session, participants engage in and reflect on two different mathematical tasks. They compare and contrast the two tasks and identify characteristics of tasks that build upon students' understanding and support their abilities to represent and communicate that understanding to others.

TRANSFORMING TASKS
The focused progression of current state standards provides teachers time to uncover important mathematics, not just cover the content. This requires teachers to choose and use tasks that go below the surface level for each math concept they teach. This session provides time for teachers to transform low-cognitive-level tasks into high-cognitive-level tasks that require students to think, reason, communicate, and make sense of mathematics.

CLOSING
Teachers need a vision of the type of work students need to be engaged in to be mathematically successful. During this session, participants reflect on the experiences of the day and plan what they will do differently in their classrooms as a result of their new or deepened understanding.

DAY TWO: MATHEMATICAL THINKING—REPRESENTATION AND PROCEDURAL FLUENCY

Current state standards call for students to develop knowledge of computational procedures along with knowledge of when and how to use them appropriately. The goal is for students to become skillful in performing computational procedures flexibly, accurately, efficiently, and with understanding.

This day provides teachers with a deeper understanding of procedural fluency beyond merely the ability to memorize procedures and apply them with little understanding. In addition, teachers will learn strategies to support students in representing ideas visually, symbolically, and verbally, as well as strategies for helping students make connections between these different representations.

OUTCOMES

- Expand their understanding of procedural fluency to include carrying out procedures flexibly, accurately, and appropriately
- Connect multiple representations for the purpose of helping all students better understand underlying mathematical ideas
- Consider students' use of tools and representations for the purpose of assessing student understanding

OPENING

This introduction includes the course goals, an overview of the course, and pertinent logistical information. Participants solve a problem to consider the big ideas of the course—procedural fluency and representations.

UNDERSTANDING PROCEDURAL FLUENCY

Procedural fluency refers to knowledge of procedures, knowledge of when and how to use them appropriately, and skill in performing them flexibly, accurately, and efficiently. In this session, participants reflect on what *flexibly* and *efficiently* mean as they engage in mental math and estimation tasks. Using their own experiences, participants consider how to use developmentally appropriate problems to support students' development of flexibility and efficiency.

USING TOOLS TO DEVELOP UNDERSTANDING

Mathematical tools are used for three main purposes: to provide a convenient and permanent record of mathematical activity; to provide a way of communicating with others; and to aid thinking. This session focuses on three kinds of tools: language, materials, and symbols. In this session, participants gain more experience with the properties and relationships of figures through the use of tools and discussion of the relevant mathematical concepts. They focus on the role of teacher questioning in directing students' work with various tools in ways that support developing understanding of important mathematics.

LUNCH

CONNECTING MULTIPLE REPRESENTATIONS

In this portion of the day, participants explore multiple representations of a mathematics problem and discuss the role of representations in communicating mathematical approaches, arguments, and understandings. As participants experience how different representations highlight different aspects of the concept, they recognize that when instruction includes the use of representations that are familiar to students—relevant situations, manipulatives, pictures, spoken language, graphs, or equations—students interpret, communicate, and discuss the idea with others to make connections among these representations, and build deeper understanding of the underlying mathematics.

CLOSING

Teachers need opportunities to translate professional learning experiences to practical classroom application. During this session, participants reflect on the experiences of the day and plan what they will do differently in their classrooms as a result of their new or deepened understanding.

DAY THREE: PROBLEM SOLVING—DEVELOPING DISPOSITION, COMPETENCE, AND CONFIDENCE

Current state standards call for students to make sense of problems and persevere in solving them. Teachers' instructional practices directly affect students' confidence in their mathematical skills and their willingness to persevere to solve difficult problems.

This day provides teachers with a deeper look at building perseverance in problem solving. Participants learn strategies for engaging students in appropriate levels of constructive struggle, thus allowing all students to approach mathematics with confidence and competence. Teachers learn how to maintain the integrity of high-level tasks by structuring lessons to allow students to make connections and develop new mathematical knowledge.

OUTCOMES

- Describe the features of a classroom environment that support student learning and promote confidence and perseverance in students
- Engage students in constructive struggle that develops mathematical habits of mind
- Structure lessons in ways that require critical thinking and sense making

OPENING

In this session, participants solve a problem that introduces them to the notion of perseverance and confidence in problem solving—along with the role of the teacher in supporting and

nurturing these qualities in students. They are introduced to the course learning outcomes, and they review the habits of mathematical thinkers to be addressed during the day.

EXAMINING THE NATURE OF TASKS
Both task selection and lesson facilitation promote a positive disposition in all students toward mathematics, competence in doing mathematics, and feelings of confidence in their ability to do mathematics. In this session, participants experience firsthand an example of a task that is rigorous yet accessible to all students.

PROBLEM SOLVING AND CONSTRUCTIVE STRUGGLE
This session highlights the importance of constructive struggle in classroom environments that support students' practice of making sense of mathematical problems and persevering in solving them. Participants solve a problem that is an example of a problem that is accessible for all students yet maintains the rigor called for in current state standards. The task provides participants with an opportunity to communicate orally about their solutions and write to explain their thinking. In processing this experience, participants discuss important ideas about the role that constructive struggle plays in developing problem-solving skills in students.

LUNCH

ANALZYING ASPECTS OF LEARNING
The intent of current state standards is to move toward greater focus and coherence in teaching and learning math. In this session, participants identify mathematical concepts that students need to experience in a specific way so that these concepts make sense to them. After engaging in mathematical investigations, participants identify mathematical ideas around which students need to reason and make sense.

EXAMINING THE PROBLEM-SOLVING LESSON
This session focuses on structuring lessons to maximize students' opportunities to make sense of important mathematical ideas. During this session, the participants engage in a task and use the experience to make explicit connections between the role of the teacher and each phase of the lesson.

CLOSING
Teachers need opportunities to translate professional learning experiences to practical classroom application. During this session, participants reflect on the types of work students need to be engaged in to be mathematically proficient and plan what they will do differently in their classrooms as a result of their new or deepened understanding.

MATH SOLUTIONS GUIDING PRINCIPLES
Drawing upon academic work and our own classroom-grounded research and experience, Math Solutions has identified the following four instructional needs as absolutely essential to improving instruction and student outcomes:

- Robust Content Knowledge
- Understanding of How Students Learn
- Insight into Individual Learners through Formative Assessment
- Effective Instructional Strategies

These four instructional needs drive the design of all Math Solutions courses, consulting and coaching. We consider them our guiding principles and strive to ensure that all educators:

- Know the math they need to teach—know it deeply and flexibly enough to understand various solution paths and students' reasoning.
- Understand the conditions necessary for learning, what they need to provide, and what students must make sense of for themselves.
- Recognize each student's strengths and weaknesses, content knowledge, reasoning strategies, and misconceptions.
- Have the expertise to make math accessible for all students, to ask questions that reveal and build understanding, and help students make sense of and solve problems.