Math Solutions
FOUNDED BY MARILYN BURNS

AGENDA
Using Formative Assessment to Impact Student Learning, High School

OVERVIEW

Based on Math Solutions' experience with the Gates Foundation Mathematics Design Collaborative, this course helps high school teachers engage students in the rigorous mathematics called for in the Common Core State Standards. Using formative assessment lessons produced by the Shell Centre in England and the University of California at Berkeley, participants extend and apply a fundamental understanding of formative assessment for the purpose of promoting student learning.

OUTCOMES

- Apply a fundamental understanding of formative assessment for the purpose of promoting student learning
- Shift classroom culture to one in which students take responsibility for their own work and teachers prompt students to reflect and reason through their ideas
- Conduct classroom dialogue in ways that supports students' mathematical thinking
- Provide feedback to students that helps them be metacognitive about the quality of their arguments and promotes understanding
- Formulate questions to extend students' thinking
- Select and use tasks for formative assessment that exemplify the Standards for Mathematical Practice and attend to learning targets aligned with the Common Core State Standards

Day 1

Opening (30 minutes)

This introduction includes the course goals, an overview of formative assessment, information on the Mathematics Assessment Project (Shell Center), and pertinent logistical information.

Functions and Everyday Situations (100 minutes; 10 minute break included)

In this session, participants engage in a Classroom Challenge that involves translating between everyday situations and graphs that represent them. Prior to the experience, they spend time considering the classroom culture needed to engage students in the process of formative assessment and begin to foster such an environment among themselves. Following the experience, participants consider the design of the challenge that lends it to being an assessment *for* learning.

Developing Strategies for Modeling (75 minutes)

Participants engage in a problem solving challenge that is designed to help students develop strategies for modeling. During the session, participants interpret a situation, represent constraints and variables mathematically, make sensible estimates and assumptions and

communicate their reasoning clearly. Pedagogically, participants reflect on strategies for promoting productive classroom discourse. Following the experience, participants consider the design of the challenge that assesses, then develops, students' ability to apply their mathematical knowledge and reasoning in flexible ways to non-routine, real-world application problems.

LUNCH (60 minutes)

Analyzing Student Responses and Providing Feedback (35 minutes)
The effective use of formative assessment lessons depends on the quality of feedback given by teachers to students. One important way of moving students' thinking forward is to prompt them to reconsider their reasoning by asking carefully chosen questions. In this session, participants analyze three responses from students' work on *Having Kittens*. They consider each student's response in terms of his or her capacity to use each of the phases of mathematical modeling (*formulate, reason, interpret and evaluate, communicate and reflect)*and practice framing questions that would provide students with helpful feedback.

BREAK (10 minutes)

Building and Solving Equations (80 minutes)
In this session, participants engage in another concept development lesson. Throughout the experience, they examine aspects of formative assessment and the new roles that teachers and students must assume for learning to take place.

Closing (5 minutes)
Participants reflect on the experiences of the day by completing an exit ticket.

Day 2

Opening (30 minutes)
Exploratory talk enables reasoning to become audible and 'publicly' accountable. In this opening session, participants read transcripts of classroom discussions and consider how the discourse either helps or hinders learning. Participants generate strategies for encouraging productive classroom discussions and continue to add to their list throughout the remainder of the day.

Using Questions to Develop Thinking and Reasoning (115 minutes; 10 minute break included)
The effective use of formative assessment lessons depends on the quality of feedback given by teachers to students. One important way of moving students' thinking forward is to prompt them to reconsider their reasoning by asking carefully chosen questions. In this session, participants engage in a problem solving challenge for the purpose of focusing on types of questions that develop thinking and reasoning.

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Evaluating Statements about Length and Area (75 minutes)
In this session, participants engage in a classroom challenge that emphasizes reasoning and understanding proof. Throughout the experience, they consider how to use these challenges to emphasize the Standards for Mathematical Practices.

Lunch (60 minutes)

Solving Quadratic Equations: Cutting Corners (80 minutes; 15 minute break included)
In this session, participants review the fundamental understandings of formative assessment they have formed during the course. As they engage in the problem solving lesson *Solving Quadratic Equations: Cutting Corners,* participants consider aspects of this challenge that provide opportunities for formative assessment that can be used by both teachers and students.

Closing (20 minutes)
This session connects back to the learning outcomes so that participants are prepared to move forward as they go back into classrooms and implement both the instructional strategies modeled throughout the institute and the actual Shell Center formative assessment Classroom Challenge lessons.

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.

