

**AGENDA****Expressions, Equations, and Functions****Grades 6-8****OVERVIEW**

This course focuses on how students develop algebraic reasoning and an understanding of the different representations for functions. Teachers and coaches explore the progression of middle school content that develops an understanding of expressions, equations, and functions and prepares students for success in high school and beyond.

**OUTCOMES**

After the session, participants will be able to:

- Engage with current state standards that address expressions, equations, and functions
- Analyze problem-solving activities that develop students' skills in these areas
- Design problem-solving lessons that address expressions, equations, and functions focus standards
- Integrate effective instructional strategies to facilitate the learning of all students
- Challenge students with rigorous math problems that require habits of mathematical thinking called for in current state standards

**Day One****Opening**

This introduction includes the course goals, pertinent logistical information, and introductory information about standards related to expressions, equations and functions. The instructor also engages participants in an algebraic thinking task to emphasize the effectiveness of such tasks in strengthening students' abilities to think, reason, and make sense of mathematics.

**Communicating about Algebraic Expressions**

In this session, participants experience a lesson intended to help students learn to translate between words, symbols, and models, as well as to use properties of operations to identify equivalent expressions. Elements of classroom discussion are highlighted to demonstrate the impact of mathematical discourse on student learning.

***BREAK*****Developing Understanding of Slope and Y-Intercept**

In this session, participants collect, record, and graph data. They find iterative and explicit function rules and analyze their findings. The experience is intended to provide a hands-on investigation to bring meaning to such concepts as function, intercept, and slope. The activity provides participants with a powerful glimpse of how the structure of a problem-solving lesson can support algebraic thinking to describe and predict phenomena in the real world.

## **LUNCH**

### **Bringing Meaning to Linear Inequalities**

In this session participants look at a real-world application for linear inequalities. They plot data and determine the inequality that best represents that data. Additionally, participants use informal and formal strategies for finding and analyzing lines of best fit, as well as analyzing and discussing patterns of association seen in the scatter plots. Participants make connections between the graphs, inequalities, and context to provide a complete picture of trends in the data. The standards related to expressions, equations, and functions have applications across other strands of the mathematics curriculum. In this session, participants see how algebraic reasoning and understanding of linear relationships are needed for success in the Statistics and Probability strand.

### **Closing (20 minutes)**

Participants look over the goals for the day and discuss how the experiences throughout the day contributed to meeting the goals. Participants take time to reflect the ways in which these experiences will positively impact their classroom instruction. Participants receive an application task.

## **Day Two**

### **Opening**

This introduction includes a review of the course goals and pertinent logistical information. Day 2 continues to focus learning on standards related to expressions, equations, and functions, while experiencing additional instructional routines that facilitate student learning. Participants share the results of their application task from Day 1.

### **Representing Quantitative Relationships Using Variables**

Using manipulatives as tools for investigating patterns provides students with a tactile and visual experience in describing and extending patterns. Manipulatives help students “see” a pattern in different ways. This experience highlights the ways in which teachers can help students understand the mathematics of patterns through the use of manipulatives.

## **BREAK**

### **Solving Systems of Equations Using Multiple Approaches**

Participants engage in a contextual problem about a walking race between a sister and a brother. In this experience, participants recognize that there is more than one approach when solving a problem. An important element of this problem is the focused opportunity to make connections between methods of finding and representing the solution. In small groups, participants write their solutions and make presentations to the whole group. They examine student work that confirms the many different ways a contextualized problem can be solved.

## **LUNCH**

### **Constructing Understanding of Algebraic Representations**

In this session, participants engage in an experience designed to help students build their understanding of the relationships between slope and  $y$ -intercept as well as those between dependent and independent variables. They gain first-hand knowledge and understanding of how graphs tell “stories” when they are analyzed. Participants engage in a learning experience and then use the experience to consider a view of learning in which people create/construct their own understanding of mathematical concepts and relationships through interactions between their minds and concrete experiences. Teachers also identify social conventions that are necessary to communicate and record their understandings.

### **Final Closing**

Participants take time to reflect on the experiences of the day as well as their overall experiences from the two-day course. Reflections include an opportunity to consider ways that these experiences will positively impact their classroom instruction.

### **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 to help students make sense of and solve problems.