AGENDA
Geometry
Grades 9-12

OVERVIEW

This course focuses on geometry experiences that formalize high school students' geometry work in elementary and middle school by utilizing more precise definitions and developing careful proofs. During the course participants engage in activities devoted to plane Euclidean geometry, both synthetically (without coordinates) and analytically (with coordinates).

OUTCOMES

- Apply a fundamental understanding of standards in current state Geometry standards to implement effective tasks.
- Integrate effective instructional strategies such as the use of classroom discourse, real-world applications, and appropriate tools to facilitate the learning of all students.
- Challenge students with rigorous math problems that require the habits of mind called for in current state standards.

Day One

Opening

This introduction includes the course goals and pertinent logistical information.

Experiencing Transformational Geometry

The concepts of congruence, similarity, and symmetry can be understood from the perspective of geometric transformation. Fundamental are the rigid motions: translations, rotations, reflections, and combinations of these, all of which are here assumed to generally preserve distance and angles, and therefore shapes. Reflections and rotations each explain a particular type of symmetry, and the symmetries of an object offer insight into its attributes.

BREAK

Understanding Geometric Constructions

The main reason for learning constructions is their close connection to the whole idea of proofs and careful thinking (axiomatic logic) that we often use geometry to teach. The skills needed to figure out how to do a construction are closely related to the thinking skills you need to prove theorems. In this session, participants engage in constructions using three different tools—straightedge & compass, patty paper and dynamic software.

LUNCH

Understanding Geometric Constructions *continued*

BREAK

Introducing the Notion of Proof

In this task, participants construct their own examples and counterexamples to help justify or refute conjectures. Participants are grouped into pairs and given some mathematical statements. Each pair chooses one of the statements and, using their own examples, counterexamples, and arguments decides if the statement is true or false.

Closing

Participants take time to reflect on the experiences of the day and ways that these experiences will positively impact their classroom instruction.

Day Two

Opening

This introduction includes a review of the course goals and pertinent logistical information.

Investigating Right Triangle Trigonometry

Pythagorean Theorem is regarded as one of the most important developments in mathematics because it links ideas of number to ideas of space. In this session, participants initially explore relationships involving angles and side lengths of right triangles. As participants explore these relationships they encounter the differences between proof and justification.

BREAK

Developing and Justifying Conjectures

Current state standards have at their foundation the expectation that students make sense of what they are learning. To acquire a deep understanding of mathematical ideas, students need to have many experiences in making and proving conjectures about geometric relationships. In this task, participants investigate geometric relationships involving the centroid of a triangle that challenge the learner to organize his or her knowledge about both medians and centroids. The instructor emphasizes making conjectures and then coming up with a mathematical justification or proof of the conjecture.

LUNCH

Exploring Analytic Geometry

Analytic geometry connects algebra and geometry, resulting in powerful methods of analysis and tools for problem solving. Geometric shapes can be described by equations, turning algebraic manipulation into a tool for geometric understanding, modeling, and proof. Geometric transformations of the graphs of equations correspond to algebraic changes in their equations.

BREAK

Exploring Analytic Geometry *continued*

Closing
This session connects back to the course goals so that participants are prepared to move forward as they go back into classrooms and implement both the instructional strategies and content lessons modeled throughout the course.

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