Math Solutions
FOUNDED BY MARILYN BURNS

Math Solutions Professional Learning

AGENDA
College & Career Ready: Ratios and Proportional Relationships, Grade 6-8

OVERVIEW

This course explores proportionality, proportional relationships, and proportional reasoning, acknowledging that the ability to reason proportionally is at the forefront of the middle school mathematics curriculum.

OUTCOMES

- Develop an understanding of the state standards for Ratios and Proportional Relationships;
- Examine problem-solving activities and investigations that develop proportional reasoning;
- Identify proportionality in all domains within state standards;
- Utilize a variety of ways to organize the classroom— whole-class, small-group, and individual learning—to maximize the learning of all students; and
- Implement instructional strategies that exemplify important mathematical habits of mind and support students' proportional reasoning.

Day One

Welcome, Introductions, and Goals

During this session, participants review the course goals and pertinent logistical information. They engage in a proportional reasoning task to emphasize the effectiveness of such tasks in strengthening students' abilities to think, reason, and make sense of mathematics.

What's My Size?

This task serves as a problem-solving situation for proportional relationships. Participants work independently to enlarge puzzle pieces so that once enlarged, the new pieces are similar to the original pieces. Participants recognize that the ratio of two quantities remains constant as the corresponding values of the quantities change in a proportion. They identify this ratio as the constant of proportionality.

Break

Fraction Action

In this session, participants describe a ratio relationship between two quantities and use ratio reasoning to solve problems, namely finding equivalent fractions.

Reflection on Morning

In this section of the day, participants engage in a problem that allows them to consider the misconceptions and challenges that students must overcome to begin to think proportionally.

LUNCH

Rods Across the Desk
In this session, activities with Cuisenaire rods provide the opportunity to apply ratio and proportion concepts and skills in a problem-solving context. The activities require discussion and explanation of ideas. The comparison of rods by thinking proportionally will set the stage for scaling two-dimensional shapes.

BREAK

Sale, Sale, Sale!
In this session, participants make sense of double number line diagrams as a visual representation of a part-whole relationship, as they make connections between characteristics of proportional relationships to percent situations. Throughout the session, participants practice using partitioning and benchmarks as strategies to make sense of percent.

Closing and Homework
Participants reflect on the pedagogy and the mathematics addressed during the day. Before dismissal, the instructor assigns homework, *Which is Juicier?*

Day Two

Welcome and Homework Discussion
This introduction recaps mathematical content from day one, provides an opportunity to review and discuss homework, and extends ideas to lead into the progression of content in day two.

It All Stacks Up
Participants actively collect data about two quantities in a real-world problem that change in relationship to one another, and represent the data collected using tables, graphs, and equations. In the context of the investigation, participants compare and contrast two relationships and use this comparison to identify components of proportional relationships.

Break

Photocopy Problem
Proportional relationships involved in enlargements and reductions of geometric figures are explored in this investigation. Participants are given images that have been enlarged or reduced on a copy machine. They use measurements to determine what button was pushed on the copy machine to create the image.

LUNCH

Typical Me
Proportional reasoning has applications across the strands of the mathematics curriculum. In this session, participants see how proportional reasoning is used to make predictions and generalizations about a population that is larger than the sub-population used for a survey.

BREAK

Centimeters to Inches
This investigation provides another opportunity for participants to consider the need for students to be able to compare quantities multiplicatively and consider strategies to support the shift from "building up strategies" to comparing the quantities multiplicatively. As participants measure objects in both centimeters and inches, they examine the proportional relationship between centimeters and inches.

Closing and Homework
Participants reflect both on the pedagogy and the mathematics addressed during the day. Before dismissal, the instructor assigns homework, *Relevant Ratios*.

Day Three

Welcome and Homework Discussion
During this opening segment, participants discuss the ratios they generated for homework. They examine the meanings and characteristics of these ratios to focus on the many ways ratios are a part of our everyday lives.

Perfect Paint
Manipulatives are used to develop the concept of a ratio as a multiplicative comparison of two sets. Participants use sets of color tiles to model a paint sample problem involving proportional relationships. They explore how equivalent ratios are formed using a multiplier, or scale factor, and use this to solve other problems involving proportional relationships.

Break

Pool Hall Math
In this investigation, participants revisit proportional reasoning in a numerical as well as geometric context. They investigate *Pool Hall Math* using rectangular tables. Participants predict where the ball will exit the table and how many hits will occur by the time the ball exits the table.

LUNCH

Designing Figures
In this investigation, participants use coordinate graphing to model transformations. Participants examine two logos and determine ways to justify whether they are similar or not.
They describe the effect of dilations and reflections on two-dimensional shapes.

BREAK

Remarkable Rectangles

Participants investigate the constants of proportionality within similar shapes as “shape ratios”, and the scale factors between pairs of similar shapes as “size ratios”, for a set of rectangles, and use these ratios to solve problems.

Reflection and Closing
Participants take time to reflect on the experiences of the course and ways that these experiences will 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 help students make sense of and solve problems.