

Math Solutions Professional Learning Aligned with *GO Math!*

AGENDA

Ratios and Proportional Relationships

Three Day series

OVERVIEW

This three-day 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. The course supports teachers using *GO Math!* with strategies to help make the content accessible to all students.

OUTCOMES

- Apply a fundamental understanding of Ratios and Proportional Relationships for grades 6 and 7 for the purpose of planning *GO Math!* lessons and task selection
- Appraise problem-solving activities and investigations that develop proportional reasoning
- Use instructional strategies in teaching *GO Math!* lessons that support students' proportional reasoning

Day One

Welcome, Introductions, and Goals

During this session, participants review the course goals and connect them to their *GO Math!* resources. Pertinent logistical information is also reviewed. Participants 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. Participants reflect on strategies to incorporate problem solving into their *GO Math!* lessons.

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. Participants consider opportunities within *GO Math!* to facilitate mathematically productive conversations for the purpose of deepening student understanding.

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. Participants discuss opportunities for incorporating multiple representations throughout their *GO Math!* lessons.

Closing and Homework

Participants reflect on the pedagogy and the mathematics addressed during the day and consider how *GO Math!* resources support efforts to implement instructional changes. 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. During this opening session, participants consider the impact of their learning on planning and implementing lessons from *GO Math!*

It All Stacks Up

In this session, participants experience a problem-solving lesson that serves as a foundational experience for analyzing components of lessons that are conducive to student problem solving. Participants consider the opportunities for problem-solving experiences provided in *GO Math!* as they actively collect data about two quantities in a real-world problem that change in relationship to one another. Participants 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.

Photocopy Dilemma

Participants explore proportional relationships involved in enlargements and reductions of geometric figures in this investigation. Working with measurements of images that have been enlarged or reduced on a copy machine, they determine what button was pushed on the copy machine to create the image. After engaging in the task and processing, participants analyze opportunities to incorporate math talk in the *GO Math!* lessons.

LUNCH**Typical Me**

Proportional reasoning has applications across the strands of the mathematics curriculum. In this session, participants use proportional reasoning 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. Participants consider opportunities for incorporating multiple representations in their *GO Math!* lessons.

Closing and Homework

Participants reflect both on the pedagogy and the mathematics addressed during the day and consider the rigor of their *GO Math!* lessons. 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. Participants then consider opportunities for enhancing student math talk in their *GO Math!* lessons.

Perfect Paint

Using manipulatives supports the development of the concept that a ratio is 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. Participants analyze opportunities to scaffold *GO Math!* lessons to provide access for all students.

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. As participants work through the investigations, they clearly see that using the scale factor on the vertices results in similar shapes. Participants also examine the relationship between the original and the new areas and consider opportunities for students to engage in similar problem solving throughout the *GO Math!* curriculum.

BREAK**Remarkable Rectangles**

Participants use multiple representations to 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 they use these ratios to solve problems. Participants reflect on the importance of connecting representations and allocating time for students to do so in the *GO Math!* curriculum.

Reflection and Closing

Participants take time to reflect on the experiences of the course and ways that these experiences will impact their classroom instruction. Connections between the course content, math talk, multiple representations, problem solving, and *GO Math!* are at the forefront of this reflection time.

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.