



MIDDLE SCHOOL MATH VOLUNTEER TRAINING

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I. OUSD’s Vision for Math and Equity

Through productive struggle, academic discourse, and performance tasks, OUSD students become problem solvers, collaborators, communicators, and owners of mathematics, to ensure college and career readiness.



OAKLAND UNIFIED SCHOOL DISTRICT
Community Schools, Thriving Students

HOW DOES THIS VISION CONNECT TO ANSWER-GETTING AND SENSE-MAKING?

A. Mathematical Norms Grounded in Sense-Making

Errors are great. They provide opportunities and promote discussion.	The answer is important, but it is not “the math.”	Asking questions until it makes sense. Sharing thoughts and having discussions are vital.	Use multiple strategies and multiple representations for one problem.
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It’s all about listening and getting students to talk about what their process is. As you tutor, you will learn how to analyze student work to identify their misconceptions and help them find the answers. We encourage "productive struggle." It is okay for a student to struggle as long as they’re learning and feeling positive.

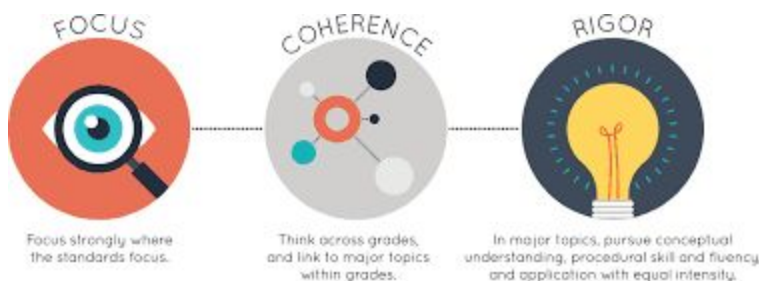
II. Common Core Standards

Through productive struggle, academic discourse, and performance task assessments, OUSD students become problem-solvers, collaborators, communicators, and owners of mathematics, to ensure college and career readiness. Common Core Standards address the different math skills needed to be math fluent.¹

A. Preflection: What do you know and what do you want to learn?

WHAT DO YOU KNOW ABOUT THE COMMON CORE MATH STANDARDS?	WHAT DO YOU WANT TO LEARN?

B. Key Shifts in Mathematics



#1 FOCUS:

Rather than racing to cover many topics in a mile-wide, inch-deep curriculum, the standards ask math teachers to significantly narrow and deepen the way time and energy are spent in the classroom.

#2 COHERENCE:

Math is a coherent body of knowledge made up of interconnected concepts. Learning is carefully connected across grades so that students can build new understanding onto foundations built in previous years. Coherence is also built into the standards in how they reinforce a major topic in a grade by utilizing supporting, complementary topics. For example, instead of presenting the topic of data displays as an end in itself, the topic is used to support grade-level word problems in which students apply mathematical skills to solve problems².

¹ The full text of the standards are available [here](#). Not necessary to know for you to be a great tutor, but just in case you're curious about what students learn in each grade!

² [This website](#) lets you explore learning progressions from grade to grade. You can also see examples of tasks/solutions.

6th GRADE

Ratios & Proportional Relationships	Understand ratio concepts and use ratio reasoning to solve problems
The Number System	<ul style="list-style-type: none">• Apply understanding of multiplication and division, fractions• Fluency with multi-digit numbers and find common factors
Expressions and Equations	<ul style="list-style-type: none">• Apply previous understanding of arithmetic to algebra• Reason about and solve one-variable equations and inequalities• Analyze relationships between dependent/independent variables
Geometry	<ul style="list-style-type: none">• Solve real-world problems involving area, surface, and volume
Statistics and Probability	<ul style="list-style-type: none">• Develop an understanding of statistical variability• Summarize and describe distributions

7th GRADE

Ratios & Proportional Relationships	Analyze proportional relationships and use them to solve real-world math problems
The Number System	Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers
Expressions and Equations	<ul style="list-style-type: none">• Use properties of operations to generate equivalent expressions• Solve real-life problems using numerical & algebraic equations
Geometry	<ul style="list-style-type: none">• Draw, construct, and describe geometrical figures & relationships• Solve real-life problems involving angles, area, and volume
Statistics and Probability	<ul style="list-style-type: none">• Use random sampling to inference and compare # populations• Investigate chance processes and develop, use, & evaluate models

8th GRADE

The Number System	Know that there are not rational numbers, and approximate them
Expressions and Equations	<ul style="list-style-type: none">• Work with radicals and integer exponents.• Understand the connection between proportional relationships, lines, and linear equations.• Analyze & solve linear equations & simultaneous linear equations.
Functions	<ul style="list-style-type: none">• Define, evaluate, and compare functions.• Use functions to model relationships between quantities.
Geometry	<ul style="list-style-type: none">• Understand similarity w. models, transparencies, or software.• Understand and apply the Pythagorean Theorem.• Real-world problems with volume of cylinders, cones, & spheres.
Statistics & Probability	Investigate patterns of association in bivariate data.

#3 RIGOR:

Each standard calls for a specific approach based on where students are in the learning progression.

- **Conceptual Understanding:** Deeply understand mathematical concepts; see math as more than a set of mnemonics or procedures
- **Procedural Skill and Fluency:** Learn methods to calculate with speed and accuracy, including the standard algorithm
- **Application:** Apply math concepts in “real world” and problem solving situations

Conceptual Understanding	Procedural Skill and Fluency	Application
<ul style="list-style-type: none"> → Understand → Reason → Explain → Interpret 	<ul style="list-style-type: none"> → Fluently → Read/Write → Evaluate 	<ul style="list-style-type: none"> → World Problems → Real World → Multi-step

III. Math Strategies to Support Sense-Making

To use these strategies, have the student “**think out loud**” so you know how the problem is being solved. If your student makes mistakes or gets stuck, thinking out loud assists in gaining a new idea for what to do next.

STRATEGY	DESCRIPTION	SAMPLE ACTIONS
#1 Searching for Patterns	Looking out for shortcuts that arise from patterns in calculations.	You Ask: <ul style="list-style-type: none"> ● “What if . . .?” (Pose variations on the problem being studied.) ● “Is there a different way to solve this problem?” (Many problems can be solved in a variety of ways.) ● “Where have you seen or used this before?”
#2 Number Talks	Students practice working out a problem in their heads, then verbalizing their process.	Encourage students to think of different ways to solve the same problem all in their heads. Instruct them to verbalize how they found their answer.
#3 Three-Read	Mathematics and language comprehension strategy designed to delay the rush to an answer, elevate student understanding of both the situation and the mathematics, and help students make sense of a problem before setting out to solve it.	1) Comprehending the Test “I want you to think about what is going on in this problem. What is the context of the situation?” 2) Comprehending the Mathematics “What are the quantities in the problem? What do they mean? How are they related?” 3) Listing All Possible Mathematical Questions “What are all the different mathematical questions you can think of about this situation?”

<p>#4 Reasoning</p>	<p>Students can explain their strategy and provide mathematical evidence / justification for the conjectures or generalizations they make.</p>	<p>You Ask:</p> <ul style="list-style-type: none"> • “How do you know what you know?” • “How do you know it’s true?” (The student makes an assertion. The tutor asks for evidence to back up the assertion.) • “Can you prove that?” • “What parts do you agree or disagree with? Why?”
<p>#5 Solving and Posing Problems</p>	<p>Solving problems algebraically, geometrically, numerically, and looking for alternative solutions. Understanding that the same process could solve multiple questions.</p>	<p>You Ask:</p> <ul style="list-style-type: none"> • “What if . . .?” (Pose variations on the problem being studied.) • “Is there a different way to solve this problem?” (Many problems can be solved in a variety of ways.) • “How might a calculator or computer help in solving this problem?” • “Where have you seen or used this before?” • “What do you think or feel about this situation?”

ELL Tip: Math has its own vocabulary and specific content language. For students learning English, it is helpful to use an action or image for math terms if they seem to be struggling. For example, a student might confuse perimeter and area. A drawing that shows the differences might help.

Resource: [Nix the Tricks](#)

- Some of the ways we learned to do math might not actually promote sense-making. This guide shows some common “tricks” that obscure mathematical meaning.

Resource: [Math Language Routines](#)

- Created by researchers at Stanford, these routines are currently the gold standard for helping multilingual learners process and develop language in math. *Compare & Connect* and *Three Reads* are two of the eight routines in this work.

Resource: [Illustrative Math Tasks](#)

- If the teacher you’re working with asks you to find tasks to do with students, this website is a great source to use! Each task outlines questions for you to ask and potential things students might say. Many of the tasks on the next pages are from Illustrative Math.

IV. Tutoring Resources

A. Helpful Links and Guides

These websites are great places to go if you want to continue your learning to support middle school math students. Always defer to your teacher's lessons. The videos and examples on these websites will prepare you to be a stronger tutor.

TOOL	USE	LINK
Common Core Sheets	Choose content by grade and find worksheets to practice a specific skill.	http://www.commoncoresheets.com/
Kahn Academy	Free videos and example lessons to practice helping students develop their math skills.	Sixth Grade: http://bit.ly/29m2nI5 Seventh Grade: http://bit.ly/29ul28h Eighth Grade: http://bit.ly/29umebG
Learn Zillion	Free videos and example lessons to practice helping students develop their math skills.	Sixth Grade: http://bit.ly/29kup8g Seventh Grade: http://bit.ly/29rF5Tc Eighth Grade: http://bit.ly/29o9qlm
Math Aids	Choose content by grade and find worksheets to practice a specific skill.	http://www.math-aids.com/
Mathnasium	Take the practice quizzes to test out your own math skills and see where you need to brush up and practice.	http://www.mathnasium.com/6th-grade-checkup http://www.mathnasium.com/7th-grade-checkup http://www.mathnasium.com/pre-algebra http://www.mathnasium.com/algebra-1
Planning Virtual Tutoring Sessions	Best practices for structuring tutoring sessions	https://www.oaklandedfund.org/wp-content/uploads/2020/07/Planning-Virtual-Tutoring-Sessions.pdf
Guide to OUSD Apps/Platforms	Use this to familiarize yourself with OUSD-approved applications. *Use varies from school to school.	https://www.oaklandedfund.org/wp-content/uploads/2020/07/Guide-to-OUSD-Online-Apps-and-Platforms.pdf

B. Scenario-based Tutoring Tips by Julia Lehman, Math Educator at UPA

Fully engage. Watch the lesson and take notes along with the teacher or sit next to a student you will be working with and pay attention/help them make sure notes are clear. If a student is learning from an online video, make sure to watch the video and learn the math the same way the students are.

- As students are working, encourage them to explain what they are doing out loud and frequently ask why. What's the next step? Why do we do that? If they have an answer, encourage them to explain why it makes sense: how do they know it's correct?
 - As students talk, prompt them with vocabulary words: ask them to be specific with units, operations, numbers. Specificity in explanation will lead to more precise math.
1. If a student is just starting a problem and feels stuck, ask them to:
 - a. Highlight and list important information
 - b. Draw a model, picture or table that will help them to solve the problem
 - c. Basic questions like, "What do we know?" "What do we need to find out?" "What kind of problem do you think this is?"
 2. If a student is struggling, don't be afraid to show them a different method. Sometimes one approach works well for one student and not for another, so a second way could be very helpful.
 3. Pay attention to basic math and use calculators when necessary. (Check with the teacher first as opinions on this might vary from class to class.) If a student is working on a ratio problem and spending 10 minutes doing the division, it might be helpful to provide them with a tool so that they are focused on the skill at hand. Let the teacher know and return to division at a later time. Often struggling students can do the grade-level math but fall behind because they are stuck on back skills. These should be covered but shouldn't slow a student down from learning the grade-level math.
 4. When working on a particular concept, if you are giving practice problems give a few different problems requiring the same mathematical strategy until it seems like the student is understanding, then add on another layer, a differently worded problem or something a little more difficult, do a few of a different type and then spiral back to the first. You want to make sure students are understanding the concept and not just the steps to solve one specifically worded problem.

THANK YOU TO OUR THOUGHT PARTNERS FOR INSPIRING MUCH OF THIS TRAINING!

6+1 Writing Traits, Achieve the Core, Core State Standards Initiative, Expeditionary Learning, Fountas and Pinnell, Kahn Academy, Julia Lehman of Urban Promise Academy, Becca Varon (Oakland School Volunteer and Common Core Math Expert), Learn Zillion, NewsELA, OUSD, Read Words, and Urban Leadership Fellow Chris Lopez.