



# DISCUSSION STARTERS for math problem solving

*by Angela Watson*

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# Discussion Starters for Math Problem Solving:

## Questions for modeling & reinforcing critical thinking skills

### **What are mathematical practices?**

The Common Core State Standards (CCSS) includes a domain called "Model and reinforce Mathematical Practices." These mathematical practices appear at every grade level and should be integrated into math instruction on all skills and concepts. The mathematical practices are:

- MP1 Make sense of problems and persevere in solving them.
- MP2 Reason abstractly and quantitatively.
- MP3 Construct viable arguments and critique the reasoning of others.
- MP4 Model with mathematics.
- MP5 Use appropriate tools strategically.
- MP6 Attend to precision.
- MP7 Look for and make use of structure.
- MP8 Look for and express regularity in repeated reasoning.

### **How am I supposed to teach mathematical practices?**

The mathematical process can seem daunting since they're more abstract than the content-based math standards. But the best way to teach mathematical practices is just by integrating them into your daily math instruction and routines in a conversational and holistic way. Modeling them, talking about them, and inviting students to talk about them are simple and powerful ways to teach math practices.

### **How can conversations about problem solving help my students develop mathematical thinking and practices?**

One of the best ways to support students in developing math practices is through verbal discussions about math problems. Sometimes these discussions are conducted through structured math talks or number talks, but they can be held throughout your math instruction: during small group work, centers, collaborative games, and so on.

Teacher-led discussions about word problems give students the opportunity to think deeply and analytically about the math skills and concepts they're learning. Specifically, talking about math problem solving helps students:

- ✓ Make sense of mathematics
- ✓ Learn and apply mathematical language and vocabulary
- ✓ Develop a wide variety of flexible strategies for problem solving
- ✓ Strengthen reasoning skills
- ✓ Solve problems effectively and efficiently
- ✓ Explain strategies and solutions
- ✓ Justify their answers using drawings and models they've created

### **What preparations should I make before having math conversations in my classroom?**

The most important thing you need to do is ensure that you're creating a supportive learning environment in which kids feel comfortable taking risks and experiencing failure. There will be many times when students try strategies that don't work or share an idea with the class that isn't successful. We want kids to view those moments as learning opportunities and not something to be ashamed of.

It's really important that students know how to listen to one another, share ideas respectfully, and respond supportively and kindly to their classmates' attempts at problem-solving. Students should be taught how to recover and rebound when they experience failure, and also how to win and lose gracefully. You'll need to model, practice, and reinforce these expectations throughout the school year, and be prepared to support students at very different levels of progress.

You'll also want to prepare effective questions and plan how you will use students' thinking to drive discussions. If you're used to doing most of the talking during your math time, this will be a bit of an adjustment for you and your students. In a good math conversation, the students talk more than the teacher. The teacher's job is to ask leading questions and probe students' thinking to encourage them to explain their ideas and share them with one another. The students' job is to be willing to try different strategies and talk about their thinking with one another and the teacher.

### **How do I lead a discussion about problem solving?**

Choose questions that will cause students to think deeply about their strategies. It's a good idea to plan these out in advance and come up with a few responses students might give so you can have follow-up questions ready. As students solve problems, you can monitor their work and ask more questions to help guide their thinking and assist them in finding solutions.

You may want to choose one or more students who have unique or well-articulated strategies to share with the class and present their work. This makes a nice "closing time" at the end of your math lesson and allows you to connect students' responses to the strategies and math concepts you're teaching.

As the school year progresses, your students will begin to do the majority of the talking and even pose their own questions instead of just answering your questions. Students will increasingly become responsible for and direct their own learning, and become more comfortable talking about their mathematical thinking and problem solving strategies.

### **What if my students don't know how to explain their thinking?**

Your initial conversations in math will probably be pretty limited, especially if you teach very young students. You'll end up doing most of the talking and your students won't yet have the words to describe what they're thinking and doing. Keep at it! Model mathematical thinking and practices on a regular (if not daily) basis. Have your more advanced students who are comfortable share their problem solving do lots of think-alouds as well. Over time, your class will internalize the vocabulary and mathematical phrases they've heard and start taking more ownership of the discussions.

### **When should I ask questions that prompt students to problem solve and think critically?**

You can facilitate conversations about math and help students construct knowledge any time students are problem solving. This includes:

- whole-class math talks, number talks, and math discussions
- problem-solving sessions conducted as a class
- mental math/mental computation mini-lessons
- complex, multi-step word problem solving instruction
- math partner games
- partner and group discussions
- small group math instruction
- math workshop
- math centers
- math stations
- math tubs
- written reflection questions
- math journals

### **Can I integrate talks about math practices with the teaching strategies I've always used?**

Sure! Lots of traditional methods of teaching math can include conversations about math practices and problem solving. For example, if you typically have students solve problems on the board while other students solve the problem at their seats, then afterward, simply ask the kids who are working at the board to explain their thinking using the conversation starters in this document.

You can also have a child at the board solve the problem before the rest of the class does and explain his or her strategies, then have students solve the problem their own way and explain the strategies they chose. Students can take turns playing this role and being the "Math Practices Leader" for the day.

If you have students work together on a math game or to collaboratively solve a problem, it can be hard to know how to guide students' conversations and refocus them. Try informally posing questions about math practices to each pair

or group as you circulate around the room, and use their responses to gauge student understanding. You may even hear some thinking from a few groups that you'd like them to share with the whole class at the end of the lesson.

### **What type of questions can I ask to guide students to problem solve?**

I've compiled over 100 questions you can use to facilitate conversations during problem solving. They're organized into the following categories:

- Preparing to solve
- Stimulating students' thinking
- Choosing strategies
- Analyzing strategies
- Active listening
- Responding when students get stuck
- Responding supportively to incorrect-/incomplete answers
- Pushing student thinking on incorrect/incomplete answers
- Assisting students in talking to one another
- Building on student responses in group conversations
- Selecting and analyzing answers
- Summing up and reflecting on math work

### **How can I use the question cards?**

You could print the cards onto card stock or mount them on construction paper, then cut them apart and store them on an "o" ring. Or, keep the pages in your plan book or as a file on your computer.

You can use the cards to help you plan your math lessons, and reference them during your conversations with students as needed. With time, these questions will become part of your teaching repertoire and will spring to mind automatically.

The questions can be used during any math lesson or activity, and are especially useful for math problem solving. During a lesson or activity, you may only use one or two questions and have students delve deeply into them through written reflections or oral discussions. Or, you might use many of the questions in a single lesson as you facilitate a discussion.

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critical thinking skills

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## Common Core State Standards

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## Choosing strategies

- ◆ What knowledge do you need to solve this problem?
- ◆ How does the information provided help you solve this problem?
- ◆ How do you know that strategy is appropriate for this problem?
- ◆ How can you prove your idea?
- ◆ Do you think \_\_\_ strategy would work? Why/why not?
- ◆ Does that strategy always work? How do you know?
- ◆ Would that strategy be true in this other situation? Why do you think that?
- ◆ Would that strategy work in all scenarios? Why/why not?
- ◆ What's another way to solve this problem?
- ◆ What strategy might someone else use to solve this problem?

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## Analyzing strategies

- ◆ What was the first thing you did to solve this problem?
- ◆ How did you think about this problem?
- ◆ What was your strategy for solving this problem?
- ◆ What did you do when you first started solving this problem? What next? And then?
- ◆ How did you know that you were finished solving the problem?
- ◆ Would you share your reasoning with me?
- ◆ What did you discover when you tried that?
- ◆ How do you know that \_\_\_ is true?
- ◆ What did you do to help solve this problem?
- ◆ What strategies did you use to solve this problem?
- ◆ Is there a different strategy for solving this problem? What else could you do?
- ◆ How did you reach that conclusion?
- ◆ How can you be sure that's true?

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# QUESTION STEMS for math practices

*by Angela Watson*



## BUT WAIT! THERE'S MORE...

I'm **Angela Watson**, the creator of this resource. I'm a National Board Certified Teacher with a masters degree in Curriculum and Instruction, and have 11 years of classroom teaching experience and over a decade of experience as an instructional coach. I currently work as a Productivity and Mindset Specialist in the area of educational consulting. In practical terms, this means I author books, design curriculum, and provide professional development services. Everything I do is centered on sharing more effective, efficient, and enjoyable ways of teaching and learning!

I founded my website ([TruthforTeachers.com](https://www.truthforteachers.com)) in 2003 to connect with other educators. You can now find thousands of ad-free articles and resources there from me and our K-12 teacher-writer's collective.

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