Standards for Mathematical Practice

There are eight standards for mathematical practice. It is likely that teachers can find evidence of each of these practices in their current teaching. Regardless, it is useful to examine them and think about how each contributes to the development of mathematically proficient students. Teachers should focus on mathematical practices while developing students' understanding of the content they support. This facilitates the development of mathematically proficient students. A brief description of each practice follows.

Practice 1: Make sense of problems and persevere in solving them. In order for students to develop the diligence intended with this practice, they must be given problems for which a pathway toward a solution is not immediately evident. Students should be encouraged to use manipulatives or drawings to help make sense of problems. They need to realize that the solution is within reach but may require diligence to persevere in finding it.

Practice 2: Reason abstractly and quantitatively. Story problems provide important opportunities for young learners to make sense of mathematics around them. Students often use strategies including acting out the problem to make sense of it. This helps them to decontextualize a situation and represent it mathematically. Students also need to be able to contextualize mathematics. That is, they need to be able to construct a context for a given mathematical representation.

Practice 3: Construct viable arguments and critique the reasoning of others. Students need to explain and justify their solution strategies. They should also listen to the explanations of other students and try to make sense of them. They will then be able to incorporate the reasoning of others into their own strategies and improve upon their own solutions.

Practice 4: Model with mathematics. Children need opportunities to use mathematics to solve real-world problems. Models may involve drawings, equations, graphs, or concrete objects. As students learn more mathematics, the ways they model situations with mathematics should become more efficient. Thus, modeling will evolve through experiences in mathematics and will change as students' understanding grows.

Practice 5: Use appropriate tools strategically. Tools include paper and pencil, number lines, manipulatives, measurement instruments, and concrete models, as well as technological tools like calculators. Mathematically proficient students are able to determine which tool to use for a given task based on its benefits or limitations.

Practice 6: Attend to precision. It is important to communicate about mathematics precisely. Using appropriate mathematical language contributes to students' precision. Precision also means calculating accurately and providing correct labels when necessary.

Practice 7: Look for and make use of structure. Patterns are evident throughout mathematics. Recognizing these patterns and building on them enhances students' ability to understand mathematics. Opportunities to do this should be pointed out when students do not recognize them.

Practice 8: Look for and express regularity in repeated reasoning. Whether performing simple calculations or solving complex problems, students should take advantage of the regularity of mathematics. A specific calculation always has the same result and recalling a similar problem can often help solve complex problems.

Supporting Mathematical Practices Through Questioning

Mathematical practices are developed through discourse that includes exchanging ideas about mathematics. Students need opportunities to discuss their solution strategies and reasoning in order to build mathematical practices. Teachers can facilitate this through questioning. The following questions are examples of how questions support students' development of mathematical practices.

When you ask. . .	*Students…*
• **What is the problem asking?** • **How will you use that information?** • **What other information do you need?** • **Why did you choose that operation?** • **What is another way to solve that problem?** • **What did you do first? Why?** • **What can you do if you don't know how to solve a problem?** • **Have you solved a problem similar to this one?** • **When did you realize your first method would not work for this problem?** • **How do you know your answer makes sense?**	**Make sense of problems and persevere in solving them.**
• **What is a situation that could be represented by this equation?** • **Why does that operation represent the situation?** • **What is another operation you could have used to represent the situation?** • **What properties did you use to find the answer?** • **How do you know your answer is reasonable?**	**Reason abstractly and quantitatively.**
• **Will that method always work?** • **How do you know?** • **What do you think about what she said?** • **Who can tell us about a different method?** • **What do you think will happen if…?** • **When would that not be true?** • **Why do you agree/disagree with what he said?** • **What do you want to ask her about that method?** • **How does that drawing support your work?**	**Construct viable arguments and critique the reasoning of others.**

Students…	*When you ask. . .*
• Why is that a good model for this problem? • How can you use a simpler problem to help you find the answer? • What conclusion can you make from your model? • How would you change your model if…?	**Model with mathematics.**
• What could you use to help you solve the problem? • What strategy could you use to make that calculation easier? • How would estimation help you solve that problem? • Why did you decide to use…?	**Use appropriate tools strategically.**
• How do you know your answer is reasonable? • How can you use math vocabulary in your explanation? • How do you know those answer are equivalent? • What does that mean?	**Attend to precision.**
• How did you discover that pattern? • What other patterns can you find? • What rule did you use to make this group? • Why can you use that property in this problem? • How is that like…?	**Look for and make use of structure.**
• What do you remember about…? • What happens when…? • What if you…instead of…? • What might be a shortcut for…?	**Look for and express regularity in repeated reasoning.**