Quick Reference Guide: Standards for Mathematical Practice *Grades 3 - 5*

To become college and career ready, students must be able to problem-solve, reason and prove, communicate, represent, make connections, conceptualize, and strategize in mathematics. While content standards are specified by grade level, the Standards for Mathematical Practice evolve and mature over the years along with students' cognitive development. By integrating content and practice standards, students become practitioners of the discipline of mathematics. **This guide describes how mathematically proficient students in grades 3–5 might demonstrate the eight Standards for Mathematical Practice in the *Massachusetts Curriculum Framework for Mathematics.***

> "The widespread utility and effectiveness of mathematics come not just from mastering specific skills, topics, and techniques, but more importantly, from developing the ways of thinking—the habits of mind—used to create the results."
>
> *-Al Cuoco, Paul Goldenberg, & June Mark*

1. Make sense of problems and persevere in solving them.

Mathematically proficient elementary students explain to themselves and others the meaning of a problem, look for entry points to begin work on the problem, and plan and choose a solution pathway. As they work, they continually ask themselves, "Does this make sense?" When they find that their solution pathway does not make sense, they look for another pathway that does. They may also consider simpler forms of the original problem.

Example: When solving a problem involving multi-digit numbers, students might first consider similar problems that involve multiples of ten or one hundred.

2. Reason abstractly and quantitatively.

Mathematically proficient elementary students make sense of quantities and their relationships in problem situations. They contextualize quantities and operations by using images or stories. They interpret symbols as having meaning, not just as directions to carry out a procedure. They can then interpret the solutions to operations in terms of the context.

Example: Students might visualize the expression 40–26 by thinking, "If I have 26 marbles and Marie has 40, how many more do I need to have as many as Marie?" Then, in that context, they may think, "4 more will get me to a total of 30, and then 10 more will get me to 40, so the answer is 14."

3. Construct viable arguments and critique the reasoning of others.

Mathematically proficient elementary students construct verbal and written mathematical arguments—that is, explain the reasoning underlying a strategy, solution, or conjecture—using concrete referents such as objects, drawings, diagrams, and actions. Arguments may also rely on definitions, previously established results, properties, or structures. Students consider to which mathematical objects (numbers, shapes, etc.) their generalizations apply.

Example: A student might argue that two different shapes have equal area, based on the previously demonstrated fact that both shapes are half of the same rectangle.

4. Model with mathematics.

When given a problem in a contextual situation, mathematically proficient elementary students identify the mathematical elements of the situation and create or interpret a mathematical model that shows those elements and relationships among them in order to deepen understanding and/or achieve a solution.

Example: When students encounter situations such as sharing a pan of cornbread among 6 people, they might first show how to divide the cornbread into 6 equal pieces using a picture of a rectangle. When the students learn to write the name of each piece in relation to the whole pan as $\frac{1}{6}$, they are modeling the situation with mathematical notation.

5. Use appropriate tools strategically.

Mathematically proficient elementary students consider the tools that are available when solving a mathematical problem, whether in a real-world or mathematical context. These tools might include physical objects (place value manipulatives, fraction bars, etc.), drawings or diagrams (number lines, tape diagrams, graphs, etc.), models of mathematical concepts, rulers and other measuring tools, virtual manipulatives, or other available technologies.

Example: Students may use graph paper to find all the possible rectangles that have a given perimeter by drawing or cutting out the possible solutions.

6. Attend to precision.

Mathematically proficient elementary students communicate precisely to others both verbally and in writing. They start by using everyday language to express their mathematical ideas, realizing that they need to select words with clarity and specificity. As they encounter the ambiguity of everyday terms, they come to appreciate, understand, and use mathematical vocabulary and symbols.

Examples: Students might specify units of measure; label charts, graphs, and drawings; calculate accurately and efficiently; and use clear and concise notation, such as the >, =, and < symbols, to record their work.

7. Look for and make use of structure.

Mathematically proficient elementary students use structures such as place value, the properties of operations, and other generalizations about the behavior of the operations to solve problems.

Example: When students calculate 16 x 9, they might apply knowledge of place value and the distributive property to find the product: 16 x 9 = (10 + 6) x 9 = (10 x 9) + (6 x 9).

8. Look for and express regularity in repeated reasoning.

Mathematically proficient elementary students look for regularities as they solve multiple related problems, then identify and describe these regularities as they use algorithms to find solutions.

Example: Students might notice a pattern in the change to the product when a factor is increased by 1: 5 x 7 = 35 and 5 x 8 = 40—the product changes by 5; 9 x 4 = 36 and 10 x 4 = 40—the product changes by 4.