Quick Reference Guide: Standards for Mathematical Practice *Pre-Kindergarten through Grade 2*

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 pre-K through 2 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.

Example: Young students might use concrete objects or pictures to show the actions of a problem, such as by counting out and joining two sets to solve an addition problem.

2. Reason abstractly and quantitatively.

Mathematically proficient elementary students make sense of quantities and their relationships in problem situations by using images or stories (contextualizing). They interpret symbols as having meaning, not just as directions to carry out a procedure.

Example: Young students might visualize the expression 11 – 8 by thinking, "If I have 8 marbles and Marie has 11, how many more do I need to have as many as Marie?" Then, in that context, they may think, "If I add 2 more that will get me to a total of 10, and then 1 more will get me to 11, so the answer is 3."

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. As they articulate and justify generalizations, students consider to which mathematical objects (numbers, shapes, etc.) their generalizations apply.

Example: Young students might discuss with a partner that a closed shape with three sides is a triangle and why changing its color or size does not make its name change.

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: Young students asked to descibe how they would share a pan of cornbread equally among 4 people might use a picture of a rectangle to represent the cornbread. The rectangle divided into 4 equal pieces is a model of the essential mathematical elements of the situation.

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 (cubes, geometric shapes, place value manipulatives, etc.), drawings or diagrams (number lines, tally marks, tape diagrams, tables, graphs, etc.), models of mathematical concepts, or measuring tools.

Example: Young students may link cubes to represent two quantities and then compare the two representations side by side.

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 rather than saying, for example, “it works" without explaining what “it" means. As they encounter the ambiguity of everyday terms, they come to appreciate, understand, and use mathematical vocabulary.

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

7. Look for and make use of structure.

Mathematically proficient elementary students use structures such as place value, the properties of operations, and number structures to generalize about the behavior of the operations.

Example: Young students recognize that adding 1 results in the next counting number. They are identifying the basic structure of whole numbers and can use this structure to reason about “one more” or “one less.”

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.

Example: Young students may notice the pattern that occurs when finding all of the number combinations that add up to twelve (11 + 1, 10 + 2, 9 + 3, 8 + 4, etc.).