

## Standards for Mathematical Practice - Fourth Grade Specific

*Mathematical Practices are listed with each grade's mathematical content standards to reflect the need to connect the mathematical practices to mathematical content in instruction.*

The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students. These practices rest on important “processes and proficiencies” with longstanding importance in mathematics education. The first of these are the NCTM process standards of problem solving, reasoning and proof, communication, representation, and connections. The second are the strands of mathematical proficiency specified in the National Research Council’s report *Adding It Up*: adaptive reasoning, strategic competence, conceptual understanding (comprehension of mathematical concepts, operations and relations), procedural fluency (skill in carrying out procedures flexibly, accurately, efficiently and appropriately), and productive disposition (habitual inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one’s own efficacy).

***Students are expected to:***

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

In fourth grade, students know that doing mathematics involves solving problems and discussing how they solved them. Students explain to themselves the meaning of a problem and look for ways to solve it. Fourth graders may use concrete objects or pictures to help them conceptualize and solve problems. They may check their thinking by asking themselves, “Does this make sense?” They listen to the strategies of others and will try different approaches. They often will use another method to check their answers.

**2. Reason abstractly and quantitatively.**

Fourth graders should recognize that a number represents a specific quantity. They connect the quantity to written symbols and create a logical representation of the problem at hand, considering both the appropriate units involved and the meaning of quantities. They extend this understanding from whole numbers to their work with fractions and decimals. Students write simple expressions, record calculations with numbers, and represent or round numbers using place value concepts.

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

In fourth grade, students may construct arguments using concrete referents, such as objects, pictures, and drawings. They explain their thinking and make connections between models and equations. They refine their mathematical communication skills as they participate in mathematical discussions involving questions like “How did you get that?” and “Why is that true?” They explain their thinking to others and respond to others’ thinking.

**4. Model with mathematics.**

Students experiment with representing problem situations in multiple ways including numbers, words (mathematical language), drawing pictures, using objects, making a chart, list, or graph, creating equations, etc. Students need opportunities to connect the different representations and explain the connections. They should be able to use all of these representations as needed. Fourth graders should evaluate their results in the context of the situation and reflect on whether the results make sense.

**5. Use appropriate tools strategically.**

Fourth graders consider the available tools (including estimation) when solving a mathematical problem and decide when certain tools might be helpful. For instance, they may use graph paper or a number line to represent and compare decimals and protractors to measure angles. They use other measurement tools to understand the relative size of units within a system and express measurements given in larger units in terms of smaller units.

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### **6. Attend to precision.**

As fourth graders develop their mathematical communication skills, they try to use clear and precise language in their discussions with others and in their own reasoning. They are careful about specifying units of measure and state the meaning of the symbols they choose. For instance, they use appropriate labels when creating a line plot.

### **7. Look for and make use of structure.**

In fourth grade, students look closely to discover a pattern or structure. For instance, students use properties of operations to explain calculations (partial products model). They relate representations of counting problems such as tree diagrams and arrays to the multiplication principle of counting. They generate number or shape patterns that follow a given rule.

### **8. Look for and express regularity in repeated reasoning.**

Students in fourth grade should notice repetitive actions in computation to make generalizations. Students use models to explain calculations and understand how algorithms work. They also use models to examine patterns and generate their own algorithms. For example, students use visual fraction models to write equivalent fractions.

## Teaching Math: A Video Library, K-4

### Meter Cords

#### Video Overview

Students in this lesson use linear measurement as the context for learning about decimals. Students work in groups to divide a meter-long piece of string into ten equal parts and to mark the tenths with colored tape. Students measure different items in the room, and record their results on a bar graph and on a chart on the computer. The class is introduced to decimals and shown how to record with symbols a length that is one meter plus two parts, or two tenths, long. These units help students develop the concepts of a meter and of decimals as they learn to write their measurements using decimal notation. Group members are assigned specific roles and the students begin measuring objects, such as the door, window, chairs, and tables. Students record their measurements by creating bar graphs and discuss notions of accuracy and precision. Students use computers to store and compare data and to create graphs. As they work, students are questioned on their understanding and guided without being given the answers. To conclude the lesson, the class discusses the student-made and computer-generated graphs.

#### Topics for Discussion

The following areas provide a focus for discussion after you view the video. You may want to customize these areas or focus on your own discussion ideas.

#### Using Measurement to Introduce Decimals

1. Describe how measurement was a context for introducing the need to learn about decimals.
2. What do you think of the approach used in the video for introducing students to decimals? What other approaches could be used?
3. What are the advantages and disadvantages of reading decimals as "inone and two tenths" versus "inone point two"? How would you ensure that students understand this connection?
4. One group measured the width of the table as twelve parts, but they were not sure how to record with decimals the result of their measurement. Students finally decided to ask Ms. Wise for assistance. What were they confused about and how did Ms. Wise respond? In what other ways could the students have been helped?
5. To what extent did students demonstrate an understanding of decimals? What is your evidence?

#### Facilitating Students' Reasoning

1. What did Ms. Wise say and do to facilitate the students' reasoning throughout the lesson?
2. What kinds of questions facilitated the students' thinking and reasoning in this lesson? What is the role of open-ended questions in promoting reasoning?

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3. Describe and evaluate the ways in which the data were displayed in this lesson. How did the graphs facilitate the students' reasoning and their discussions? What other visual representations of data could further facilitate the students' learning?
4. How did the computer contribute to the students' reasoning? How else could the computer have been used in this lesson?
5. What was the purpose of bringing students back together after they had finished their measurements and the graphs?
6. One boy in the video was unsure of the meaning of quarters. Discuss the advantages and disadvantages of using the term quarters versus fourths. How did Ms. Wise handle this situation during the lesson and assist the boy in his thinking? In what other ways could you help a student make the connection between quarters and fourths?
7. Students were asked to point out the perimeter of a table during the lesson. How did Ms. Wise help students understand the meaning of perimeter? Was the meaning of perimeter clear to students? What are some other ways to help students understand the concept of perimeter?

### Extension

#### Using Computers

Investigate the use of computers for organizing and displaying data. Consider the advantages and disadvantages of different pieces of software. Discuss how to choose software to supplement mathematics lessons. For example, you can work with a spreadsheet program and specific graphing packages to investigate displaying data as was done in the video. Once you become comfortable using some of the programs, think of and list ways to integrate them into mathematics teaching.