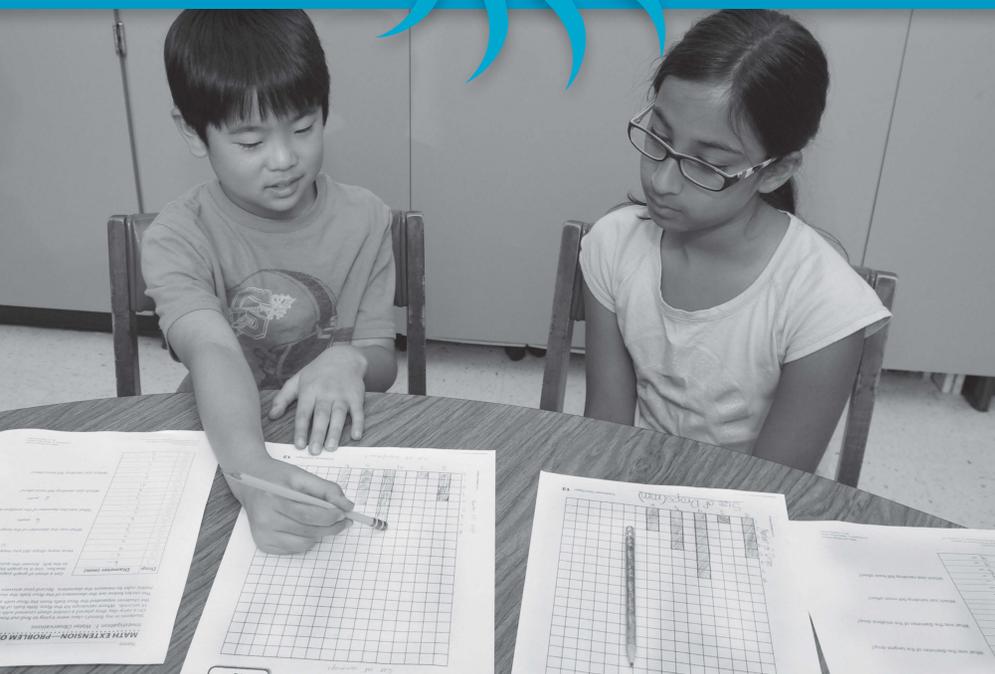


FOSS and Common Core Math — Grade 3



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INTRODUCTION

The adoption of the Common Core State Standards for Mathematics calls for shifts in focus, coherence, and rigor. The teaching of the standards should be focused on the important content, coherent from one grade level to the next, and rigorous in requiring conceptual understanding, fluency, and application. Within this area of application, FOSS provides fertile ground for the use of mathematics.

The FOSS Program integrates mathematics with science in two ways throughout the grade 3 modules. In active investigations, students apply mathematics during data gathering and analysis. In addition, the Interdisciplinary Extensions at the end of each investigation usually include a math problem of the week. These problems enhance the science learning by providing hypothetical data for students to analyze or in some way relate to the context of the investigation. The notes explain for the teacher the problem and describe how students might approach its solution. The problems are prepared for distribution to students on duplication masters in the Teacher Masters chapter of *Teacher Resources*.

This chapter gives an overview of how FOSS addresses the Common Core State Standards for Mathematics through science. It also points out specific instances in which students exercise those skills during science instruction.



Mathematical Practices

Mathematical practices consist of eight processes and proficiencies that are important for all students.

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

Within the context of science, students use some of these mathematical practices on a regular basis. According to *Next Generation Science Standards* (volume 2, appendix L, p. 138),

The three CCSSM practice standards most directly relevant to science are:

- MP.2. Reason abstractly and quantitatively.
- MP.4. Model with mathematics.
- MP.5. Use appropriate tools strategically.

When students reason abstractly and quantitatively and model with mathematics, they are using math in context. They work with symbols and their meanings and represent and solve word problems. Students choose and correctly use the available tools to collect data and solve problems. In the grade 3 modules, students engage with these three practices during the active investigation and by completing the problem of the week at the end of each investigation. Here are some examples.

In solving the problem of the week for Investigation 2 of the **Water and Climate Module**, students determine the amount of liquid water to add to different containers, so that when the water freezes, the ice fills the container to the brim. In order to solve this, students reason quantitatively and use mathematics in the context of science. They use the information that you need 45 mL of water to produce 50 mL of ice. For every 50 mL of ice, you need to subtract 5 mL to account for expansion. Students can use a model: determine how many groups of

50 mL are in the container, then subtract 5 mL for each group. So if there are ten groups of 50 mL in the container, they need to subtract ten groups of 5 mL to account for expansion.

In the **Structures of Life Module**, students determine the lifespan of two different owls in captivity and in the wild. Students model both multiplication and subtraction to solve two of the problems and reason quantitatively, using fractions, to solve another problem.

In the **Motion and Matter Module**, students are asked to reason abstractly to determine the order of tops given certain clues. This requires students to manipulate the tops either abstractly or using concrete tops they have cut out.

Mathematical Content

The mathematical content in third grade is organized around four concepts.

- Operations and algebraic thinking
- Number and operations in base 10
- Number and operations—fractions
- Measurement and data

The following pages have a table that identifies the opportunities to engage students in developing these mathematical concepts as well as those learned in grade 2. It lists the math content for second and third grades and points out relevant opportunities in the three FOSS modules for grade 3.

OPERATIONS AND ALGEBRAIC THINKING

	Standard	Motion and Matter Module
Grade 3	Represent and solve problems involving multiplication and division.	
	3. Use multiplication and division within 100 to solve word problems in situations involving equal groups, arrays, and measurement quantities, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem.	
	Solve problems involving the four operations, and identify and explain patterns in arithmetic.	
	8. Solve two-step word problems using the four operations. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding.	Inv. 1, Problem of the week

From *Common Core State Standards for Mathematics* by National Governors Association Center for Best Practices and Council of Chief State School Officers, (Washington, DC: authors, 2010)..

Structures of Life Module	Water and Climate Module
<p>Inv. 4, Problem of the week</p>	
<p>Inv. 1, Problem of the week Inv. 2, Problem of the week Inv. 4, Problem of the week</p>	<p>Inv. 1, Part 4, Step 15. Discuss the reading Inv. 2, Problem of the week Inv. 3, Problem of the week</p>

NUMBER AND OPERATIONS IN BASE 10

	Standard	Motion and Matter Module
Grade 2	Use place value understanding and properties of operations to add and subtract.	
	6. Add up to four two-digit numbers using strategies based on place value and properties of operations.	
Grade 3	Use place value understanding and properties of operations to perform multi-digit arithmetic.	
	1. Use place value understanding to round whole numbers to the nearest 10 or 100.	
	2. Fluently add and subtract within 1000 using strategies and algorithms based on place value, properties of operations, and/or the relationship between addition and subtraction.	Inv. 4, Problem of the week

Structures of Life Module	Water and Climate Module
Inv. 4, Part 1, Step 16. Revise the total bone count	
Inv. 1, Part 1, Step 10. Search for seeds	

NUMBER AND OPERATIONS—FRACTIONS FOR GRADE 3

	Standard	Motion and Matter Module
Grade 3	Use place value understanding and properties of operations to add and subtract.	
	1. Understand a fraction $1/b$ as the quantity formed by 1 part when a whole is partitioned into b equal parts; understand a fraction a/b as the quantity formed by a parts of size $1/b$.	

Structures of Life Module	Water and Climate Module
Inv. 4, Problem of the week	Inv. 1, Part 1, Step 15. Review the reading

MEASUREMENT AND DATA

	Standard	Motion and Matter Module
Grade 2	Measure and estimate lengths in standard units.	
	1. Measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes.	Inv. 1, Part 2, Step 5. Conduct the investigation in pairs Inv. 3, Part 2, Step 7. Use the meter tape to measure the distance Inv. 3, Part 2, Step 22. View online activities Inv. 3, Home School Connection Inv. 4, Part 3, Step 7. Monitor measures
	4. Measure to determine how much longer one object is than another, expressing the length difference in terms of a standard length unit.	Inv. 3, Part 3, Step 7. Guide progress as needed
	Represent and interpret data.	
	9. Generate measurement data by measuring lengths of several objects to the nearest whole unit, or by making repeated measurements of the same object. Show the measurements by making a line plot, where the horizontal scale is marked off in whole-number units.	
	10. Draw a picture graph and a bar graph (with single-unit scale) to represent a data set with up to four categories. Solve simple put-together, take-apart, and compare problems using information presented in a bar graph.	Inv. 2, Extensions: Compare rollers and spinners

Structures of Life Module	Water and Climate Module
Inv. 2, Part 2, Step 2. Begin a bean growth chart Inv. 3, Extensions: Measure the amount a crayfish eats	Inv. 1, Problem of the week
	Inv. 1, Extensions: Measure water drops
Inv. 2, Part 2, Step 2. Begin a bean growth chart	

MEASUREMENT AND DATA (continued)

Standard	Motion and Matter Module
<p>Solve problems involving measurement and estimation of intervals of time, liquid volumes, and masses of objects.</p>	
<p>1. Tell and write time to the nearest minute and measure time intervals in minutes. Solve word problems involving addition and subtraction of time intervals in minutes, e.g., by representing the problem on a number line diagram.</p>	
<p>2. Measure and estimate liquid volumes and masses of objects using standard units of grams (g), kilograms (kg), and liters (L). Add, subtract, multiply, or divide to solve one-step word problems involving masses or volumes that are given in the same units, e.g., by using drawings (such as a beaker with a measurement scale) to represent the problem.</p>	<p>Inv. 4, Part 1, Step 4. View online activity “Measuring Mass” Inv. 4, Part 1, Step 7. Conduct investigations Inv. 4, Part 2, Step 6. Start the investigations Inv. 4, Part 3, Step 7. Monitor measures</p>

Grade 3

Structures of Life Module	Water and Climate Module
	<p>Inv. 5, Extensions: Compare different soils</p>
<p>Inv. 1, Part 3, Step 5. Weigh dry lima bean seeds Inv. 1, Part 3, Step 11. Weigh the soaked seeds Inv. 1, Extensions: Determine the mass of multiple seeds Inv. 3, Extensions: Compare the mass of crayfish</p>	<p>Inv. 1, Part 3, Step 5. Conduct the investigation Inv. 1, Part 3, Step 12. View online activities Inv. 1, Extensions-Weigh water and Capture raindrops Inv. 2, Part 1, Step 11. Mix hot and cold water Inv. 2, Part 4, Step 5. Set up the containers to be frozen Inv. 2, Part 4, Step 14. Observe the syringes and vials Inv. 2, Extensions: Freeze salt water and Compare the densities of salt and plain water Inv. 3, Part 1, Step 4. Go outdoors Inv. 3, Part 1, Step 6. Collect and share weather data Inv. 3, Part 1, Step 12. Make comparisons Inv. 3, Part 3, Step 3. Set up the tray Inv. 3, Part 3, Step 6. Measure the evaporation results Inv. 3, Part 4, Step 6. Measure water Inv. 3, Part 4, Step 12. Measure the water Inv. 5, Part 1, Step 5. Get equipment and begin</p>

MEASUREMENT AND DATA (continued)

Standard	Motion and Matter Module
<p>Represent and interpret data.</p>	
<p>3. Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories. Solve one- and two-step “how many more” and “how many less” problems using information presented in scaled bar graphs. For example, draw a bar graph in which each square in the bar graph might represent five pets</p>	
<p>Geometric measurement: understand concepts of area and relate area to multiplication and to addition.</p>	
<p>5. Recognize area as an attribute of plane figures and understand concepts of area measurement.</p> <ul style="list-style-type: none"> a. A square with side length 1 unit, called “a unit square,” is said to have “one square unit” of area, and can be used to measure area. b. A plane figure which can be covered without gaps or overlaps by n unit squares is said to have an area of n square units. 	
<p>6. Measure areas by counting unit squares (square cm, square m, square in, square ft, and improvised units).</p>	

Grade 3

Structures of Life Module	Water and Climate Module
<p>Inv. 1, Part 1, Step 6. Count and graph the seeds in the pods</p> <p>Inv. 2, Problem of the week</p> <p>Inv. 3, Part 2, Step 35. Discuss results</p> <p>Inv. 3, Problem of the week</p> <p>Inv. 4, Part 4, Step 13. Create a thumbprint bar graph</p>	<p>Inv. 1, Problem of the week</p> <p>Inv. 4, Part 1, Step 7. Make bar graphs of the weather data</p> <p>Inv. 4, Problem of the week</p>
	<p>Inv. 3, Part 3, Step 11. Read "Surface-Area Experiment"</p> <p>Inv. 3, Extensions: Measure and graph surface area</p>
	<p>Inv. 3, Part 3, Step 11. Read "Surface-Area Experiment"</p> <p>Inv. 3, Extensions: Measure and graph surface area</p>

