

“Change is an important mathematical idea that can be studied using the tools of algebra. For example, as part of a science project, students might plant seeds and record the growth of a plant. Using data represented in the table and graph . . . students can describe how the rate of growth varies over time.”

From the National Council of Teachers of Mathematics “Algebra Standards for Grades 3–5” in *Principles and Standards for School Mathematics*, 2000.

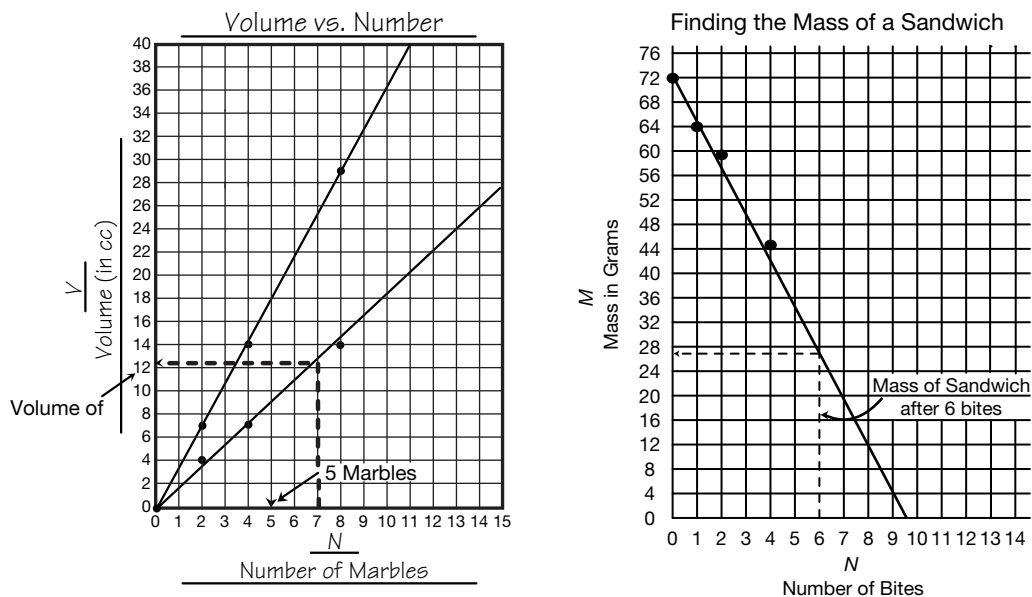
“Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity and trends.”

From the Common Core State Standards Initiative “Common Core State Standards for Mathematics”, 2010.

**Patterns and Rules.** Students explore, analyze, and extend patterns in this unit. Each activity promotes students’ mathematical reasoning and prepares them for the formal study of algebra in later grades. While real-world data may not fit an exact mathematical pattern, many situations give rise to patterns, and we use these patterns to make the best possible predictions.

Students analyze both increasing and decreasing relationships represented in data tables, graphs, and rules. For example, using graphs, students predict the volume of a number of marbles (an increasing function) and the number of bites it will take to eat a sandwich (a decreasing function). See Figure 1.

Students use “function machines” to explore relationships in data. Each function machine takes a number called the “input,” applies its rule, and emits a new number as its “output.” For example, the doubling machine outputs the number that is two times the input number. Work with these machines serves several purposes. At the most basic level, it helps students reinforce and extend their experiences with the four operations. More importantly, the lessons deal with recognizing and describing numerical patterns. These concepts are important building blocks for the understanding of algebra.



**Figure 1:** Increasing and decreasing relationships represented in graphs

**Mass and Volume.** Most of the problems in this unit involve mass or volume. Concrete experiences with measuring and comparing volume and mass develop students' abilities to check for reasonableness and to estimate the mass and volume of objects. Students using *Math Trailblazers* have had many experiences with both mass and volume beginning in kindergarten. In this unit, students will revisit measuring the volume of objects by displacement and estimating the volume of small objects by building models with centimeter cubes. In the *Volume vs. Number* lab, students will predict the volume of a given number of marbles. Students improve their predictions by looking for patterns represented in tables and graphs. Students then compare different units of volume. For example, students use patterns represented in tables to determine the number of milliliters in a given number of liters.

Students will revisit the concept of mass during the *Sandwich Mass* lab. They will measure the mass of a sandwich to track how the mass changes with each bite. Students then use patterns to predict the number of bites it will take to eat the entire sandwich.

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## Resources

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- *Aesop's Fables*. Compiled and illustrated by Jerry Pinkney. SeaStar Books, New York, 2000.
- Brownell, W. "The Evaluation of Learning in Arithmetic." In *The National Council of Teachers of Mathematics Sixteenth Yearbook: Arithmetic in General Education*. W.D. Reeve, ed. Bureau of Publications, Teachers College, Columbia University, New York, 1941.
- Common Core State Standards Initiative (CCSSI). *Common Core State Standards for Mathematics*. National Governors Association Center for Best Practices and the Council of Chief State School Officers, D.C., 2010.
- National Research Council. *Knowing What Students Know: The Science and Design of Educational Assessment*. Committee on the Foundations of Assessment. J. Pelligrino, N. Chudowsky, and R. Glaser, eds. National Academy Press, Washington, DC, 2001.
- *Principles and Standards for School Mathematics*. National Council of Teachers of Mathematics, Reston, VA, 2000.
- U.S. Bureau of the Census, *Statistical Abstract of the United States: 2001, The National Data Book* (121st edition), Washington, DC, 2001.