

“Students with conceptual understanding know more than isolated facts and methods. They understand why a mathematical idea is important and the kinds of contexts in which it is useful. They have organized their knowledge into a coherent whole, which enables them to learn new ideas by connecting those ideas to what they already know. Conceptual understanding also supports retention. Because facts and methods learned with understanding are connected, they are easier to remember and use, and they can be reconstructed when forgotten.”

National Research Council, *Adding It Up: Helping Children Learn Mathematics*, p. 118, 2001.

This unit is the first in a series of multiplication and division units distributed throughout the year. Building on their experiences in first and second grades, third-grade students will begin a more formal study of the concepts, applications, notation, and procedures of multiplying and dividing. As recommended in the NCTM’s *Principles and Standards for School Mathematics*, the units emphasize the development of concepts and the use of computation to solve problems. Students investigate multiplication and division by solving problems and sharing solutions and strategies with one another. Your role is to help students connect their thinking about multiplication and division to the appropriate mathematical symbols and to help them become more efficient in their estimation and computation.

In this unit, multiplication is introduced in a variety of settings. As students solve many types of problems, introduce the use of multiplication sentences linking the symbols to students’ informal procedures (Carpenter, Carey, and Kouba, p. 127, 1990).

Students continue to explore the idea that the equal sign represents the relationship between two equal quantities. They decide whether number sentences such as $3 \times 4 = 4 + 4 + 4$ are true or false and find the missing numbers in open number sentences of the form $\quad \times 4 = 4 + 4 + 4$.

In later units, students will continue to investigate multiplication by collecting data and looking for patterns in data tables and graphs. These patterns provide a context for building multiplication tables and developing strategies for learning the basic facts. Students will also explore the patterns involved in using multi-

ples of ten to facilitate estimation and to check the reasonableness of their results. When students are familiar with underlying concepts and skills, they will write and solve story problems involving larger numbers. These problems act as a catalyst for developing an understanding of two-digit by one-digit multiplication. Calculators are used to assist students in their investigations and problem solving involving large numbers and complex calculations.

Math Facts and Mental Math

The goal of the math facts development in *Math Trailblazers* is for students to learn the basic facts efficiently, gain fluency with their use, and retain that fluency over time. A large body of research supports an approach in which students develop strategies for figuring out the facts rather than relying on rote memorization. This not only leads to more effective learning and better retention, but also to the development of mental math skills. In fact, too much drill before conceptual understanding may interfere with a child’s ability to understand concepts at a later date.

The research that contributed to the National Council of Teachers of Mathematics *Principles and Standards for School Mathematics* and the National Research Council’s *Adding It Up: Helping Children Learn Mathematics* has informed the structure of the math facts strand in *Math Trailblazers*. Also see the Unit 2 Letter Home for more about the development of the basic facts in 3rd-Grade *Math Trailblazers*.

Multiplication Facts. This unit begins a systematic review and assessment of the multiplication facts to develop mental math strategies, gain fluency, and to learn to apply multiplication strategies to larger numbers. Students study small groups of facts that can be solved using similar strategies. See Figure 1.

Unit	Multiplication Facts Group	Focus
3	5s and 10s	Development of mental strategies and number sense
4	2s and 3s	
5	Square Numbers	
6	9s	
7	Last Six Facts	
8	5s and 10s	Use strategies fluently
9	2s and 3s	
10	Square Numbers	
11	9s	
12	Last Six Facts	
13	Last Six Facts	

Figure 1: Development of multiplication facts in Grade 3

Students work on developing number sense for the multiplication facts for the 5s and 10s in this unit by writing stories, drawing pictures, and writing number sentences for math facts. See the Letter Home and Figure 2.

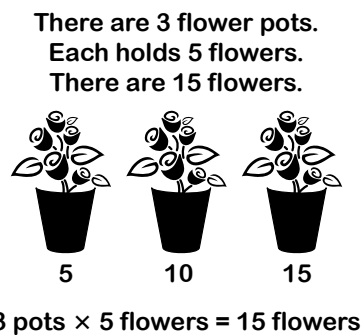


Figure 2: Multiplication story with picture and number sentence

Subtraction Facts. Students review the following subtraction facts to maintain and increase fluency and to learn to apply subtraction strategies to larger numbers. See Mathematics In This Unit in Unit 2 for more about subtraction facts development.

Group 3: $10 - 4$, $9 - 4$, $11 - 4$, $10 - 8$, $11 - 8$, $9 - 5$, $10 - 6$, $11 - 6$, $11 - 5$

Group 4: $10 - 7$, $9 - 7$, $11 - 7$, $10 - 2$, $9 - 2$, $9 - 3$, $10 - 3$, $11 - 3$, $9 - 6$

Algebra in the Early Grades

Children who develop a rich capacity for reasoning about general relationships among quantities will possess the conceptual foundation for using symbolic and generalized representations like those used in algebra. So, in this unit, students draw pictures and use reasoning to develop their thinking about multiplication. Students also describe their reasoning and thinking with the support of number sentences and drawings.

The more concrete, intuitive, and situation-specific patterns of reasoning, appropriately supported and nurtured over a period of years, can foster students' development of the algebraic reasoning we value so highly (Smith and Thompson, 2008).

Resources

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